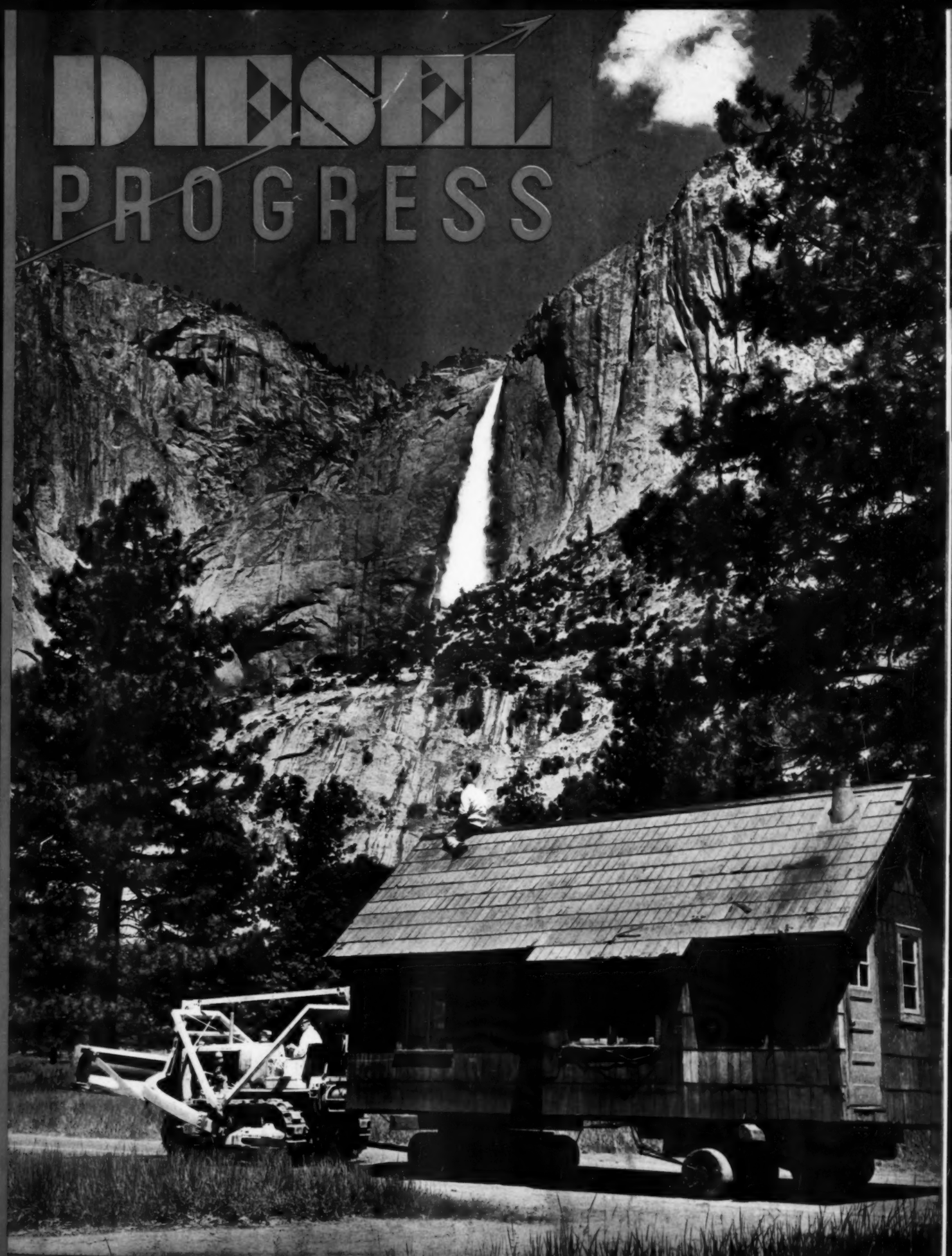
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



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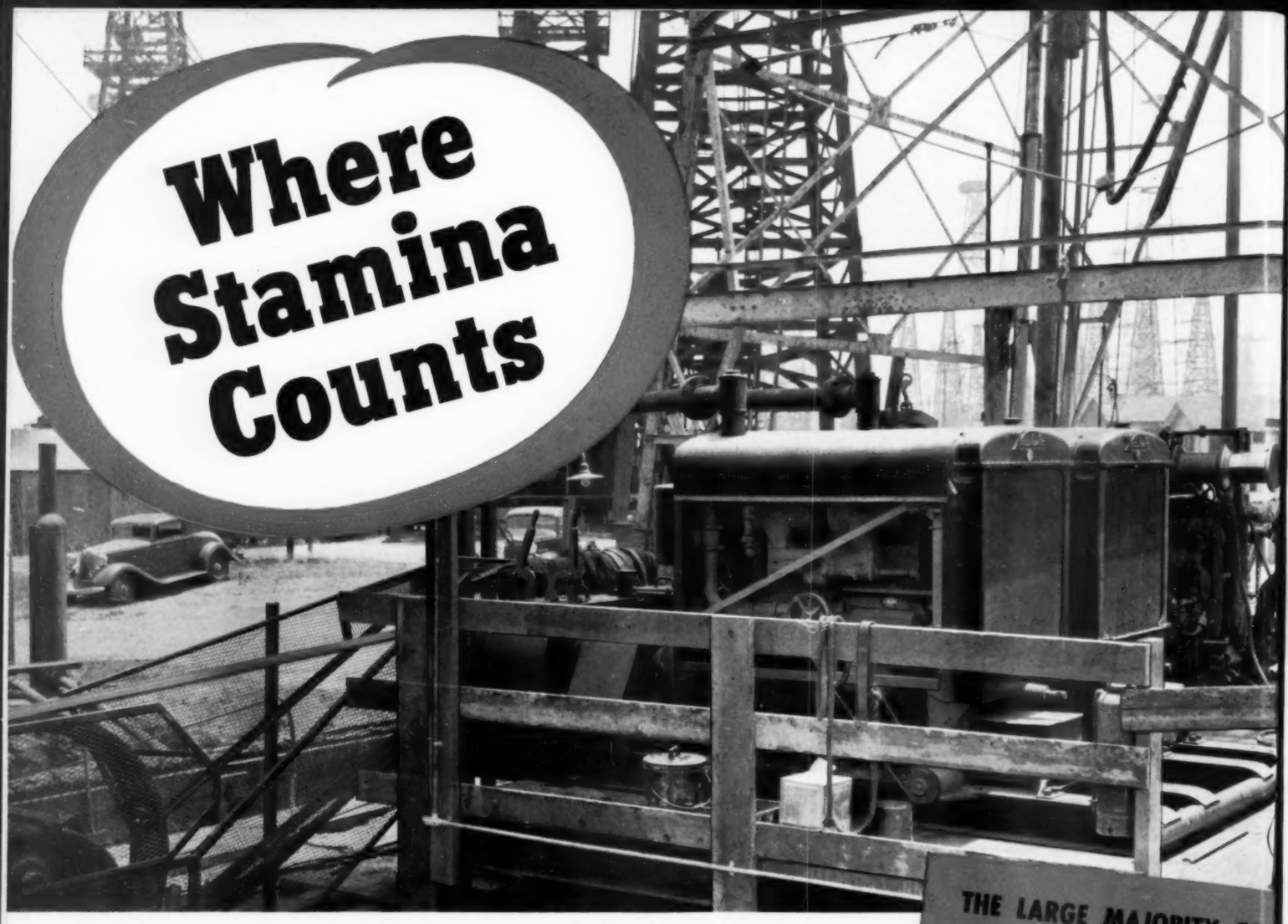

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In heavy-duty Diesel operations of every description . . . wherever reliable performance and utmost operating efficiency are determining factors . . . there will you find Perfect Circle "M" Alloy *Ferrox Surfaced* Piston Rings. For—*where stamina counts*—these scientifically engineered piston rings are first choice of the majority of Diesel engine manufacturers using rings up to 8½ inches in diameter.

The exclusive *Ferrox Surface* of Perfect Circle "M" Alloy Piston Rings does away with initial scuffing and scoring because it polishes rings and walls to mirror-like smoothness . . . continues to retard wear even after thousands of operating hours. The special "M" Alloy gray iron material of which these rings are made enables them to retain their conformity and tension under most exacting conditions . . . effectively resists the terrific heat of combustion chambers. Special finishes, too, assure rapid wear-in . . . *where stamina counts!*

Perfect Circle engineers will be glad to help you work out a solution to your piston ring problems. Feel free to call upon them at any time. The Perfect Circle Companies, Hagerstown, Ind., U. S. A. and Toronto, Canada.

THE LARGE MAJORITY OF DIESEL-POWERED TRACTORS, INDUSTRIAL UNITS, AND STREAMLINERS USE

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"M" ALLOY PISTON RINGS AS ORIGINAL EQUIPMENT

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PERFECT CIRCLE *PISTON RINGS*

CONTENTS FOR JUNE

CCA

REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION: Yosemite Park & Curry Co. operates a Caterpillar Diesel tractor to level camp sites, clear roads, wreck cabins, lift poles around the skating rink for the winter season, etc. Here it is shown moving cabins from Government Center to the Curry Maintenance Yard. The haul is a mile and a quarter in length and the tractor scuttles back and forth on 2½ gallons of fuel an hour.

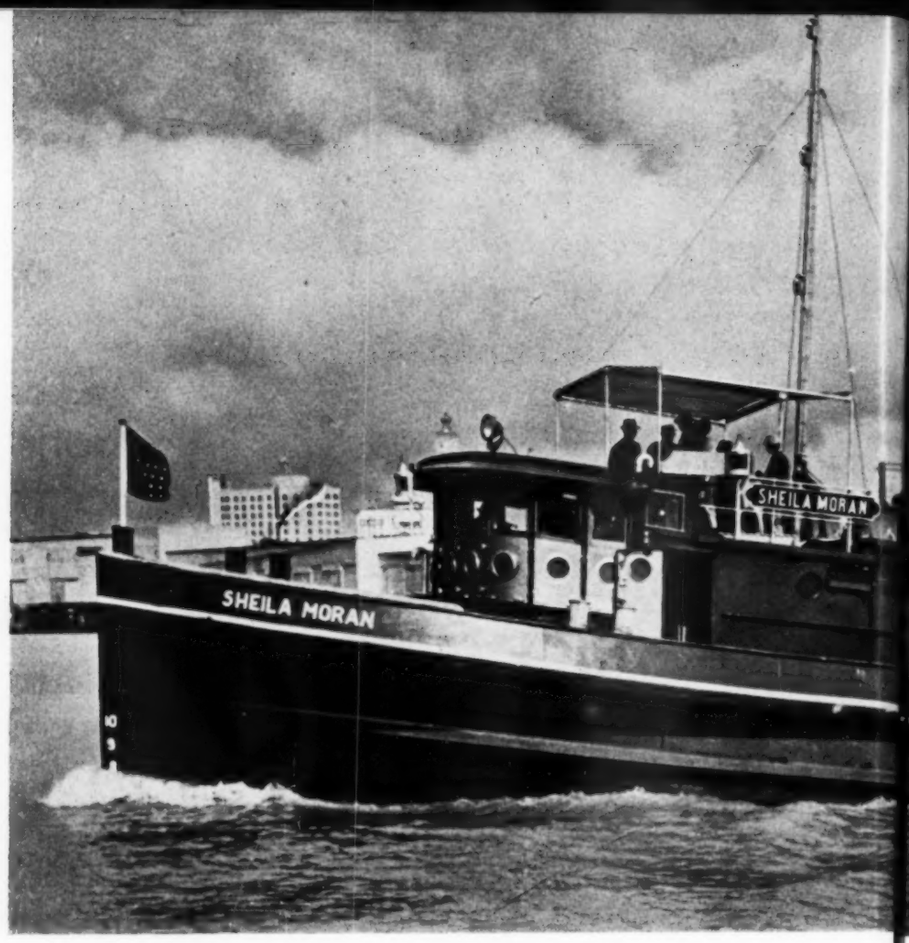
TABLE OF CONTENTS ILLUSTRATION: The Diesel Yacht *Wakiva*, owned by Harkness Edwards of Lexington, Kentucky, measures 70 ft. 3 in. by 15 ft. 2 in. by 9 ft, and is powered with a Buda 4-cylinder Diesel engine.

HEYWORTH CAMPBELL
Art Director

PAUL H. WILKINSON
Aviation Editor

DIESEL ELECTRIC TUG "SHEILA MORAN"

By WILL H. FULLERTON



Latest addition to the fleet of Diesel-powered towboats of the Moran Towing and Transportation Co. of New York.

DEFINITE trend to the use of only one instead of two Diesel engines in electric drive vessels was demonstrated in New York Harbor on Friday, May 12, with the arrival of the *Sheila Moran,* latest addition to the Moran Towing and Transportation Company's rapidly expanding fleet of Diesel-powered towboats.

Powered by a General Motors twelve cylinder, 2-cycle Diesel engine rated at 750 hp., and direct-connected to a 600 kw. exciter generator, the *Sheila Moran* arrived from Beaumont, Texas, where she was built and had her trials at the Pennsylvania Shipyards, Inc.

A sister ship, the *Peter Moran,* is now being completed at Beaumont, and will have her trial runs late this month. The new towboats will increase to five the number of General Motors Diesel-powered towboats in the Moran fleet.

The *Sheila Moran* gave an excellent account of herself on her trial run, held April 27, on a course of two measured miles off the builder's plant on the Natches River. Providing an average speed of 13.1 miles, the new boat answered every demand in superb fashion. She left Beaumont on May 1 for New York, taking the outside course, and was placed in service in New York Harbor and the New York State Barge Canal.

Both of these new boats are built to the hull design of the *Marie S. Moran,* an outstanding Diesel towboat built by Pennsylvania Shipyards, and powered for the Moran Company by General Motors in 1936. The owners have established the *Marie S. Moran* as the standard of excellence in general performance and economy, and believe that a combination of her hull characteristics and the latest type of Diesel-electric marine power plant will give them an outstanding vessel.

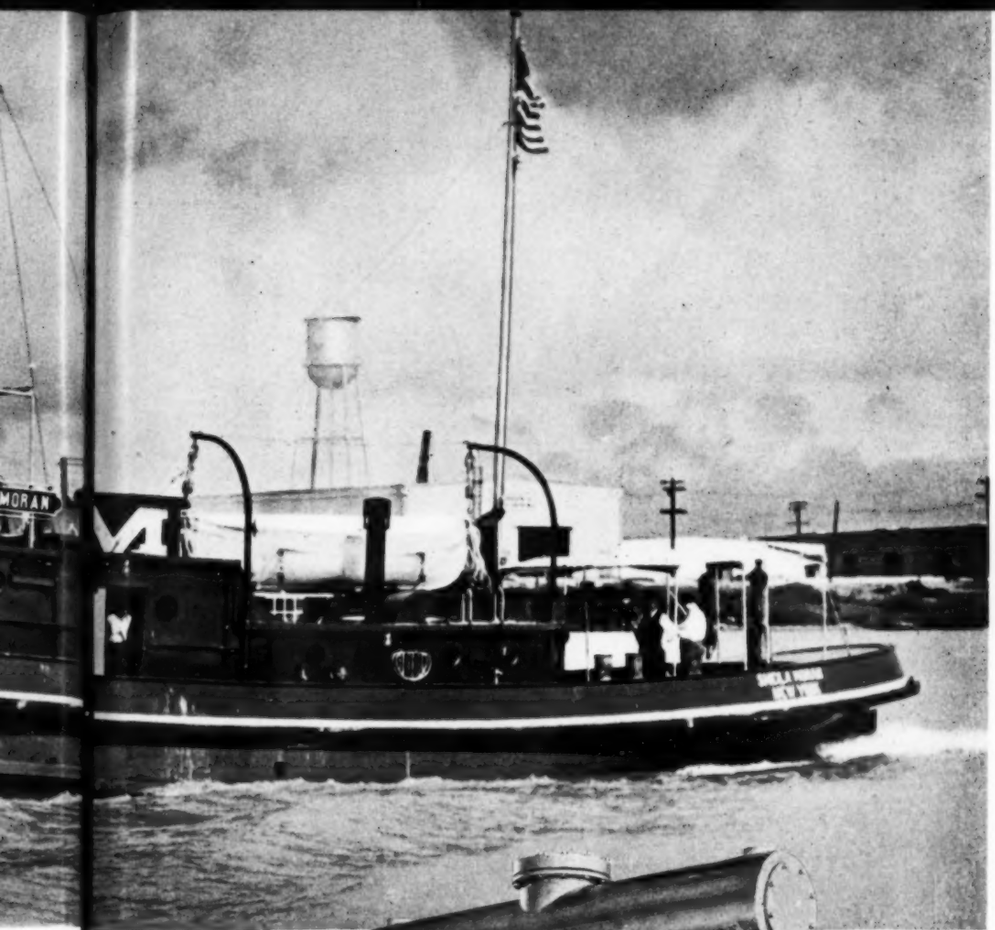
Following the plan adopted in powering the *Thomas E. Moran* and *William J. Moran,* placed in service by the Moran Company last year, each of the new towboats has a 750-hp. Farrel-Birmingham reduction gear placed between the propelling motors and the propeller. This gear permits the installation of light-weight, high-speed propulsion motors, as well as the low maintenance cost and rugged construction necessary for hard, continuous service.

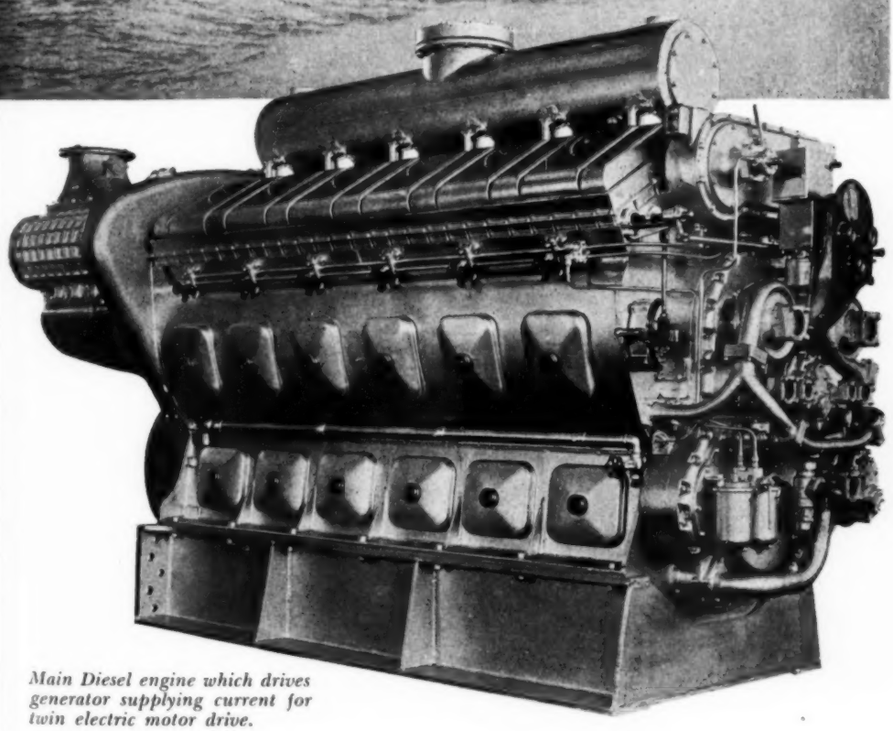
Instead of running the engines at constant speed, as is customary in this type of drive, the engines in these new-type boats operate at half speed until the propeller reaches half speed. Beyond this, higher propeller speeds are obtained by increasing the engine speed in seven steps up to full engine speed. This feature provides a decided decrease in operating cost, especially in service requiring less than full load operation of the engines.

The exceptional maneuverability and remote control provided by electric drive are particularly desirable in the service in which these vessels will be used – their work will be performed in the close waters of the New York State Barge Canal System, on the Hudson River, Great Lakes, and in the New York Harbor. The boats are fully capable of coastal voyages and ocean towing. The ideal combination of latest-type boat design, General Motors two-cycle Diesel engines, and electric drive, will enable these new towboats to give exceptional service in handling huge ocean-going ships. Economy in fuel consumption will permit long, non-stop towing trips and efficient year-around service.

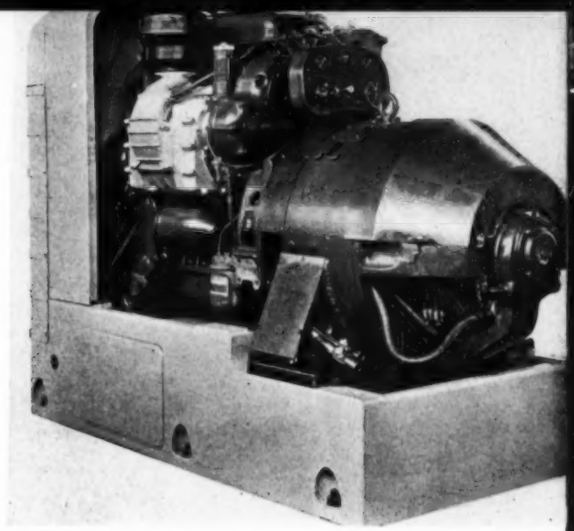
The propulsion mechanism in these boats can be controlled from four stations – from the pilot house, aft deck, bridge, and engine room. Maximum propeller horsepower is obtained in a range which permits handling heavy tows efficiently at low speed.

Distinctly modern design and equipment provide exceptional comfort and service facilities. The boats have an over-all length of 93 feet; beam 22 feet; draft 10 feet 9 inches.





Main Diesel engine which drives generator supplying current for twin electric motor drive.



Auxiliary Diesel generating set used for charging the lighting batteries and to supply current to the ship's auxiliaries.

Hull and superstructure are all-steel, electrically welded. Power for the propulsion motors in each tug is obtained from one General Motors Model 12-567, two-cycle, Diesel engine, rated at 750-hp. at 750-rpm., and direct-connected to a 600-kw. direct-current generator. The engine also drives a 24-kw. exciter generator by a V-belt connection. Electric power is generated in the main generator and is transmitted to the two 375-hp. propulsion motors which are connected through a reduction gear to the propeller. Connections between the generator and motors are made through switches on the switch panel mounted on each main generator. The generators, motors and control panels for these two boats were supplied by the General Electric Co. Installed in each vessel for auxiliary power is a General Motors Model 3-71, two-cycle, Diesel engine, rated 45-hp. at 1200-rpm., direct-connected to a 30-kw. generator.

Included in the very complete accessory equipment aboard the *Sheila Moran* is a Youngstown Miller oil purifier which, in effect, re-refines the lubricating oil from both the main and auxiliary engines on a batch system. The Moran Towing and Transportation Co. now has several of these Youngstown Miller units in service on their various tugs with complete satisfaction. Exide ironclad lighting batteries and Exide MVAHT-25 generator batteries are installed. Both the main and auxiliary engine exhaust silencers are Maxim. All valves and fittings are Crane. Harrison Radiator Division of General Motors supplied the lube oil cooler and the heat exchanger. A Woodward Type S1 governor controls the main engine and a Woodward Type 86A9 governs the auxiliary engine. A Delco Remy electric starter and a Delco starting battery generator supply the starting mechanism for the auxiliary engine. Purolator fuel oil and lube oil filters are on both main and auxiliary engines. The capstan is a Benson Electric unit, as is the steerer.

A Jones Motrola tachometer serves the main engine. A Viking pump handles the fuel oil service requirements. The fuel oil strainer is an Elliott. Ingersoll Rand supplied the auxiliary air compressor, which is motor driven. The American Blower Company supplied both the forward and aft motor driven blowers.

All in all, the *Sheila Moran* and her sister ship mark a new era in Diesel Electric drive: one engine of the high speed, compact type which, of course, makes possible a small engine room, leaving more room for crews' quarters, etc.

A DIESEL FOR A LIGHTHOUSE

By GEORGE D. CROSSLEY

AT Point Arena, California, jagged rocks jut out into the Pacific, threatening the coastal shipping lanes. Strong tides and swift currents are their dangerous allies. Spectacular shipwrecks in the past have made the spot colorful and dramatic in the history of the west.

Point Arena's danger was recognized early, and its first lighthouse erected in 1870. Around the turn of the century, earthquakes destroyed it, and left the district again a danger-spot for costal vessels.

In 1908, however, the second tower was built, and today stands as a modern highly-efficient lighthouse, maintained by the United States Light House Service, and designed to guide shipping safely past this precarious point.

One hundred fifty-five feet above water level rises a slim graceful white tower, visible in itself for miles at sea when conditions are clear. After darkness, 390,000 beam candle-power flash white every twenty seconds at the tower's crest. Steamers 19 miles away can see this light and read its warning. Behind this signal stands a sturdy Caterpillar Diesel engine, driving a 6.6 kw. generator throughout the night, providing steady dependable electricity. Homes and shops around the lighthouse also depend on this plant for their lights and power.

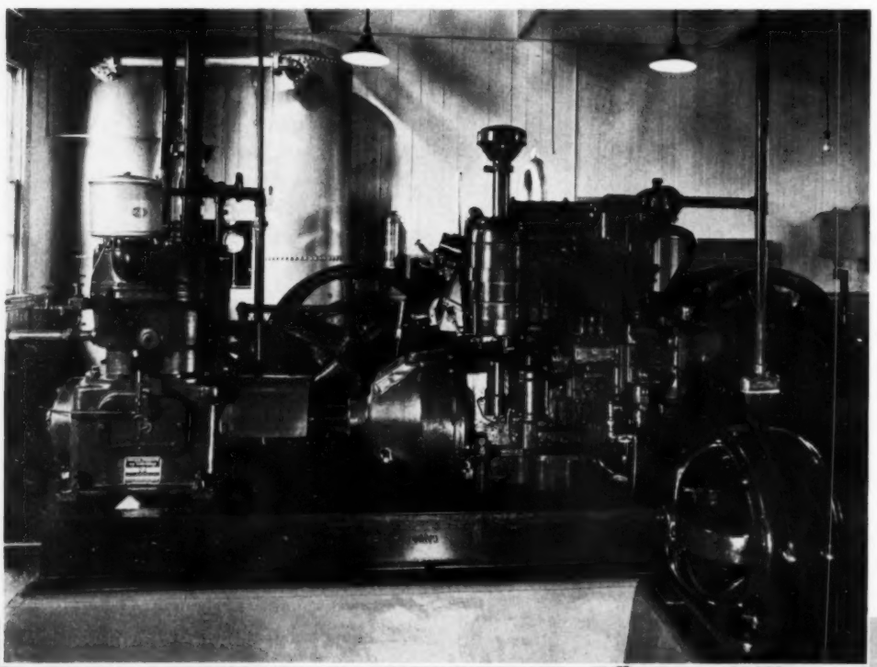
When Point Arena is completely obliterated from the sea by fogs which sweep up from the ocean frequently, the powerful warning light loses much of its effectiveness. For such cases, a horn, or diaphone blasts away, two blasts every 60 seconds, its low call audible from three to ten miles at sea, depending upon conditions.

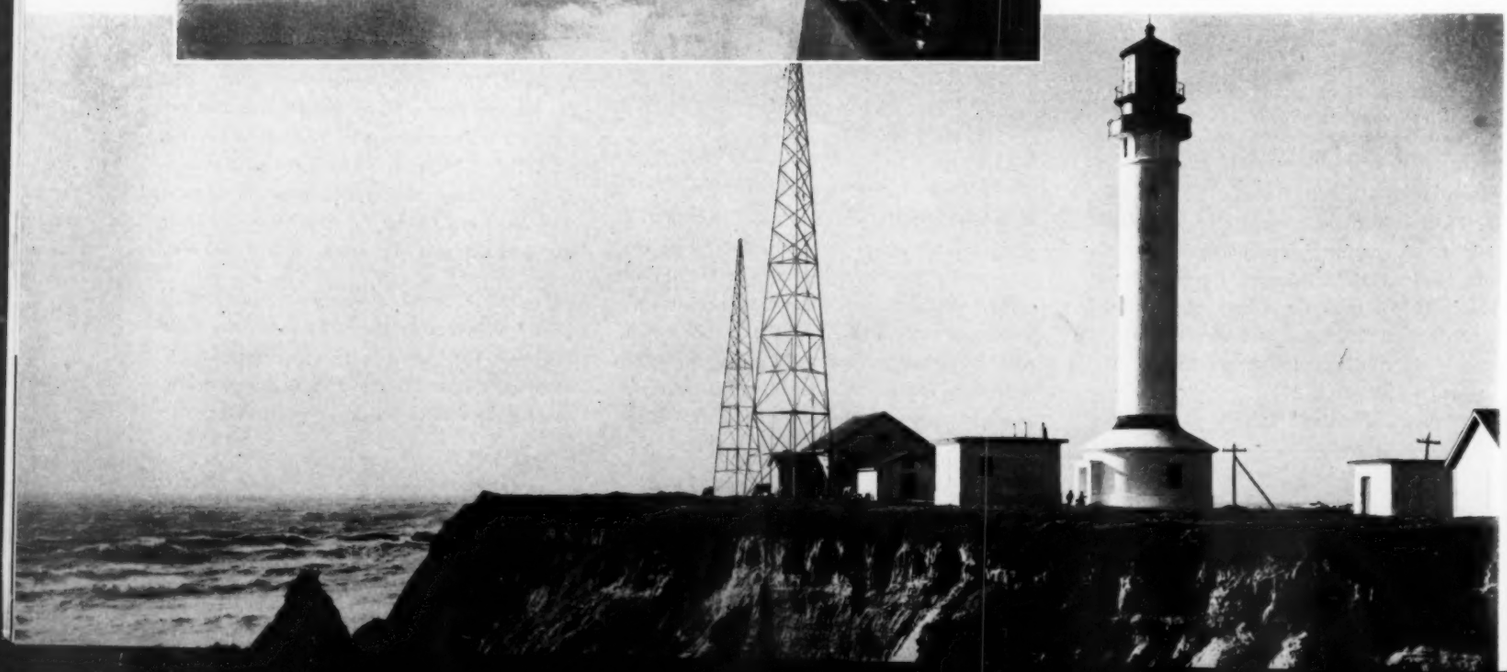
The same three cylinder engine, direct-connected to a 7 x 6 compressor, builds up pressure to keep the diaphone working steadily.

Point Arena's quietest but farthest carrying voice is its 292 kilocycle, 200-watt radio beacon, which flashes out dash and dot signals for 60 straight seconds, and then is silent for twice as long. Its call has been heard accurately up to 1,400 miles away. Power for this also comes from the Diesel engine and generator.

The Diesel was purchased to replace a gasoline engine, which could not provide sufficient power to run the diaphone satisfactorily. In addition, it will replace four small gasoline units that formerly generated electricity for the beacon and radio.

Surprisingly, after the engine was installed, a fuel saving of approximately 50 per cent was experienced, according to the lighthouse superintendent. This was unexpected, due to the fact that gasoline and Diesel oil deliver for approximately the same figures (11c) at the Point.





Equipped with Western Electric ship-to-shore radio telephone and Bludworth direction finder, the latest addition to the Bushey fleet comes up to the minute in towboat design, being the first boat of its kind with insulated and sound-proofed engine room.

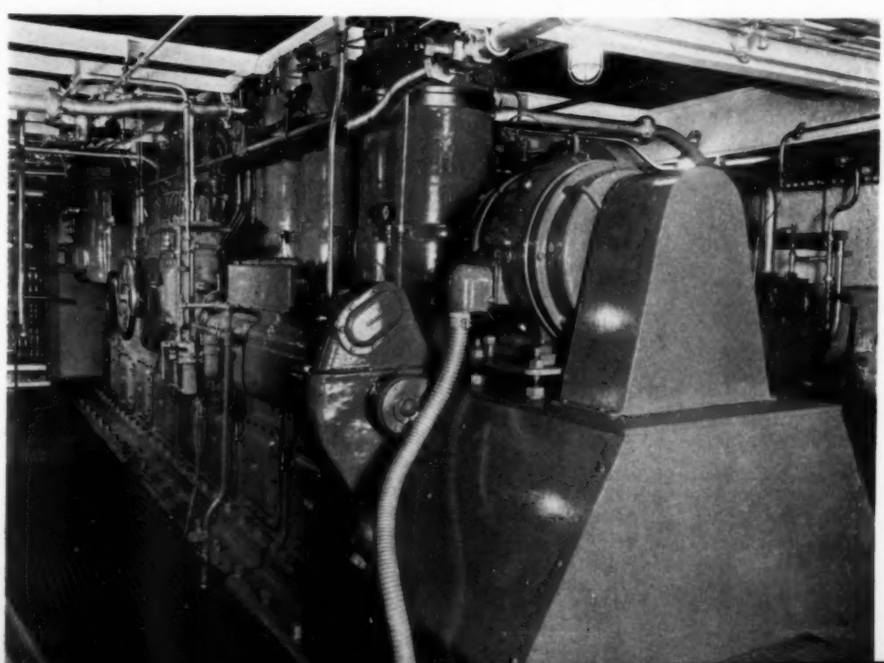
NEW DIESEL TOWBOAT "CHAPLAIN"

By REX W. WADMAN

ON Saturday, May 20th, the new towboat *Chaplain*, designed and built by Ira S. Bushey & Sons, Inc., rounded the point of lower Manhattan on her trial run. Thoroughly modern and embodying several noteworthy innovations, the *Chaplain* typifies the acumen of generations of experience in the Bushey family.

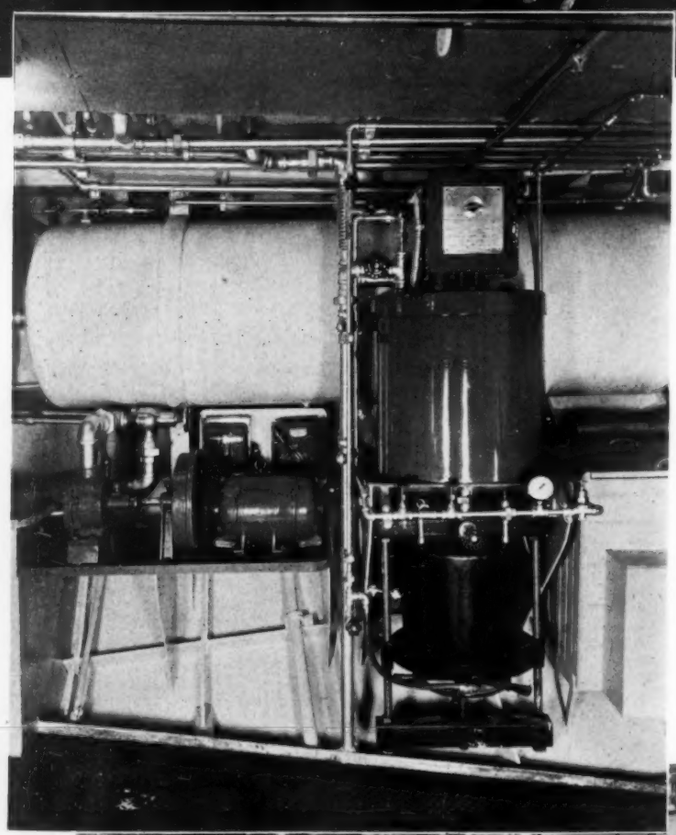
The common tendency to conserve first cost in the construction of towboats, Francis Bushey has found, usually results in excessive maintenance expense as well as inefficient performance. So we find in the *Chaplain* a fine balance of design, utilizing the proved efficiency of Diesel propulsion and auxiliary engines with an unusual amount of thought given to the comfort and convenience of the crew.

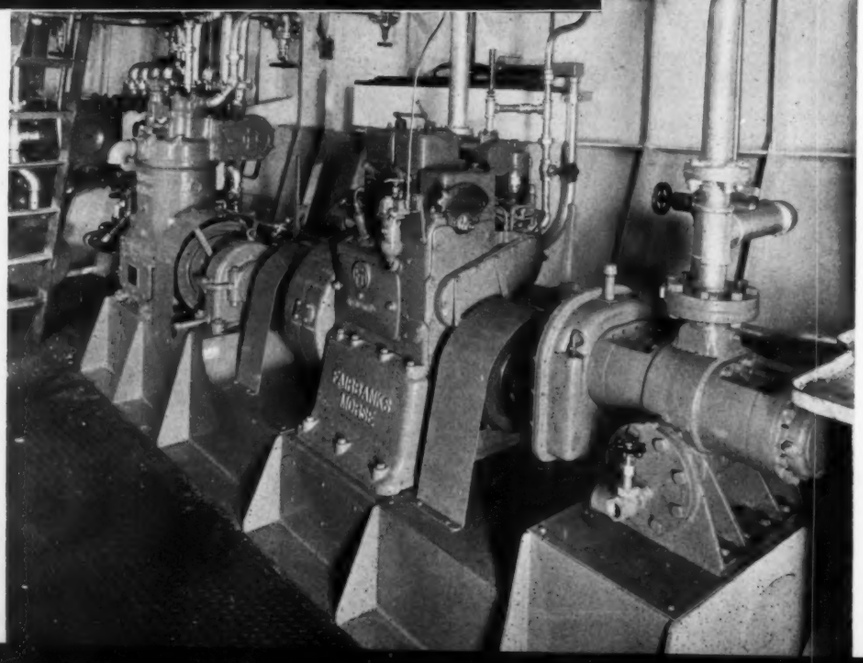
Operating side of main Diesel engine; note chain and cable extending upward from control wheel to the remote engine control located in the upper engine room.



The main engine room, located amidship with bulkheads fore and aft, houses the propulsion engine and all auxiliaries. Following a long established Bushey practice, Fairbanks-Morse engines, generators and pumps were again selected. The main engine is a Fairbanks-Morse Diesel, 7 cylinder, 14 in. bore, 17 in. stroke, 2 cycle, 805 hp., with built-in fuel, lube oil, and jacket circulating water pumps also scavenging air compressor. Engine room auxiliary equipment includes duplicates of all engine built-in pumps. These duplicate pumps are electric motor driven to provide lubrication while starting the engine and for cooling after stopping, as well as fuel oil and jacket cooling water for starting purposes. The engine is of the backflow scavenging type with open head

View aft of pilot house showing radio telephone installation with Weston tachometer and light switch panel to the left.





Left: Youngstown Miller lube oil reclaimer installation. Below: auxiliary Diesel engine driving a two stage Gardner - Denver air compressor, left background, and fire pump, right foreground.

combustion and oil cooled pistons. Airless injection is through differential injection valves. The drive is direct to an 84 by 48-3-blade Columbian bronze propeller and the engine is direct reversing.

The auxiliary Diesels are Fairbanks-Morse 2 cylinder, 4½ in. bore, 6 in. stroke, 20 hp., connected through a Link Belt gear to a Gardner Denver 5½ in. by 2½ in. by 5 in. stroke, two stage air compressor and a plunger type fire pump, and another 4 cylinder, 4¼ in. bore, 6 in. stroke, 40 hp. engine direct-connected to a Fairbanks-More marine type 20 kw., 110-volt generator, which furnishes charging current for the bank of Edison storage batteries and for driving auxiliary electric motors.

A closed fresh water cooling system with Schutte-Koerting combination water and lube oil coolers is provided for all three Diesel engines.

Intake air is supplied from an intake duct through the top deck to a Maxim intake silencer mounted in the engine room. A spark arrester type Maxim exhaust silencer is installed in the stack.

Lube oil is reclaimed in a Youngstown-Miller oil purifier.

The Smith-Meeker switchboard is equipped with Westinghouse circuit breakers, Weston meters, and Cutler-Hammer control switches. A Fairbanks-Morse remote engine control and the gauge board carrying a Brown exhaust

Views of mess room, extreme left, and living quarters, above, are evidence of excellent provisions for the comfort and convenience of the crew.

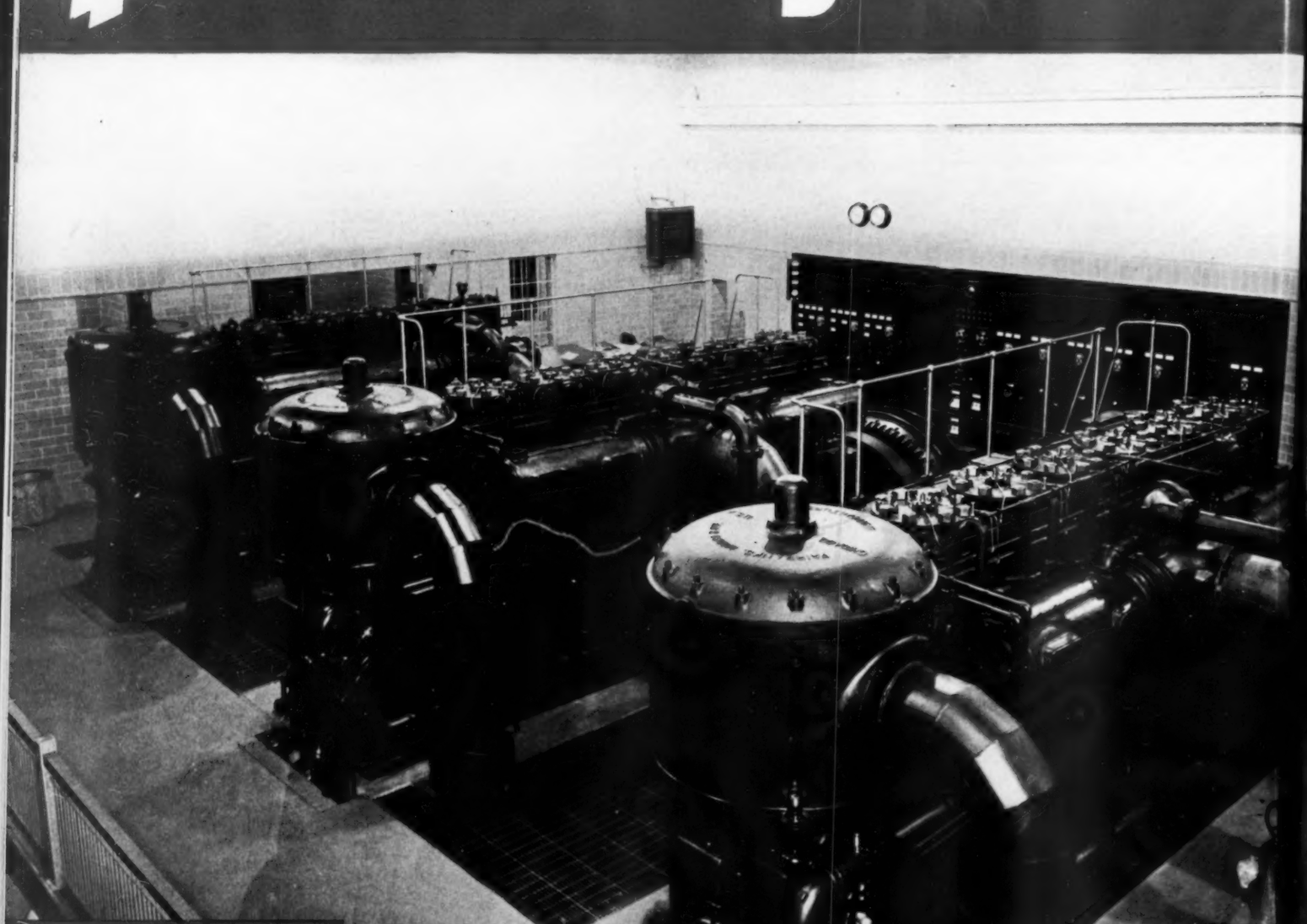
pyrometer and Weston tachometer are located in the spacious upper engine room. All valves are Lunkenheimer.

Coming back to the general construction of the *Chaplain,* her length is 90 ft., beam 22.6 ft., and draft 11 ft. Her hull is constructed of Lukens steel, all welded, as has been Bushey practice since they built the first all-welded hull ten years ago. The *Chaplain* has a gross tonnage of 127, a net of 86. The engine room is insulated all over against weather, vermin, and rodents, with mineral wool supplied by the U. S. Gypsum Co. This insulation is veneered with sound proof perforated sheeting furnished by Johns Manville. This is the first boat of its kind to receive complete engine room sound proofing which, combined with insulation of the entire superstructure, is calculated to greatly enhance the comfort of the crew.

The crew's quarters, fitted with two bunks each, are finished in teakwood with nickel trim. A porcelain wash bowl fitted with hot and cold running water, a medicine chest, metal clothes locker, electric fans, screen doors, shower stalls, and ample heating facilities enable the crew to live aboard the *Chaplain* in more than ordinary comfort.

This latest addition to the Bushey fleet presented an outstanding picture of efficient power and utility on her trials. She is also striking in appearance from the simulated oak paneled superstructure down to her clean-cut, sturdy hull – typically Bushey.

Best for Diesel Engines!



SEALED POWER'S RECENT CONTRIBUTIONS TO THE DIESEL INDUSTRY

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- Corrosion Resisting Rings
- Alloyed Irons For Special Applications
- Hi-F Oil Control Rings
- Special Oil Scraper Rings
- Joint Seal Compression Rings
- Positive Seating Compression Rings
- Self-lubricating Rings

Fairbanks-Morse Choose SEALED POWER NG with GRANOSEAL SURFACE

Tribute to the excellence of Sealed Power Rings with Gra l Su face is their selection by Fairbanks-Morse engineers. A l F-I installation is shown here in the Jacksonville, Ill., muni plan

Special Iron

SEALED POWER PISTON RINGS *with* GRANOSEAL SURFACE

BEST for Diesel engines! That's the verdict of engineers. They say that on sheer performance, you just can't beat Sealed Power Piston Rings.

Easy to understand why: Sealed Power Rings for Diesel engines have more years of engineering background behind them than any other rings on the market. For years, Sealed Power engineers have led the field in developing rings that produce results. Sealed Power Piston Rings are specified as standard equipment by more Diesel engine manufacturers than any other make.

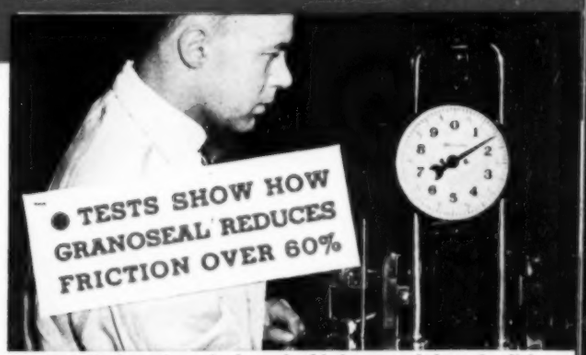
And Now Granoseal Surface!

New performance records are now being established with Sealed Power Rings due to the Granoseal process.

This amazing surface development reduces friction over 60%! It prevents scuffing, is oil absorbing. Tests prove that Granoseal adds hundreds of hours to ring and cylinder life.

So outstanding is the performance of Granoseal that Fairbanks-Morse and other manufacturers are now specifying Granoseal as standard equipment. In addition, they are using the Granoseal process on valve guides, bushings, camshaft bearings, and other parts subject to excessive wear and scanty lubrication.

Whatever your Diesel piston ring problems are, Sealed Power engineers can produce the ring for the job—and remember we stand ready to cooperate with you in every way. Call on us.



E. C. Beck, engineer, looks at the friction recorded on the dial of the Friction Dynamometer as the cast iron plate revolves against an untreated cast iron piston ring specimen.

A little lower—but still plenty of friction is recorded on the dial of the Friction Dynamometer as the cast iron disc is revolved against specimen with surface No. 2.

Not so good, says the dial, as the cast iron plate is revolved against a piston ring specimen with surface No. 3. The dial shows that an excess amount of friction develops.

GRANOSEAL! Look at the difference! Practically a 3/5 reduction over the untreated cast iron ring specimen. That's why rings surfaced with Granoseal wear longer and serve better.

SEALED POWER PISTON RINGS

SEALED POWER CORPORATION
MUSKEGON, MICHIGAN
Canadian Factory, Walkerville, Ontario

Piston Rings, Pistons, Pins, Valves, Sleeves, Spindle Bolts and Bushings

CHAIN STORE DIESELIZES

By WILBUR W. YOUNG

THE H. L. Green Co., operating 240 stores in the United States, Canada, and England, recently purchased a Diesel generating plant for their store at 93rd St. and Broadway, New York City. While this store is housed in a single story building with basement, no means is provided for use of daylight. The new power plant was, therefore, installed to furnish brilliant lighting at low cost as a necessary adjunct to this attractive department store.

The power plant selected is a Blackstone, Type SP, single cylinder, horizontal, 4-cycle Diesel engine, with a Gates multiple Vee-belt drive to a Star, Type GY-505-256, 33 kw. alternator with a direct-connected outboard exciter, operating at 1,200 rpm.

The engine bore is 10 in., the stroke 14 in., and it develops 50 hp. at 450 rpm. The flywheel is 4 ft. 8 in. in diameter with a 7½ in. face, beside which is mounted a 32 in. by 14 in. pulley on the extended crankshaft which is supported in an outboard bearing. The cylinder liner is chrome hardened by the "Listard" process (Van der Horst patents) which gives it a hardness equivalent to 3,000 Brinnel. A copper gasket forms a pressure joint between the liner and the cylinder head. The crankcase is fitted with a large cover to permit insertion and withdrawal of the piston and connecting rod, and to facilitate inspection of the bearings which are of the split adjustable type.

The totally enclosed valve mechanism consists of pull rods which are actuated by cams and bell-crank levers. The cams are driven by a spiral gear from the crankshaft. Intake and exhaust valves are mounted in vertically opposed positions in the cylinder head with the combustion chamber between them. The built-in governor, spiral geared to the crankshaft controls the amount of fuel delivered by the fuel pump to the injector according to the load on the engine. A Viking Type R-18 automatic safety stop operates on the fuel pump, stopping the engine in the event of low lube oil pressure or excessively high jacket water temperature. Engine speed can be adjusted while the engine is in operation by means of a nut which controls the tension of the speeder spring.

The engine lubrication system consists of a plunger pump driven by a cam on the crankshaft supplying oil from a sump in the crankcase to the main bearings, crankpin, governor, and valve gear. The pistons, cams, and cam levers are lubricated by splash. A Briggs clarifier is installed between the pump and the distributing lines for filtering lube oil.

This H. L. Green Co. store, at 93rd St. and Broadway, New York, is brilliantly lighted during the day and evening by a Diesel generating plant on the premises.

Fuel injection equipment is a Cav-Bosch pump and nozzle. Fuel oil is drawn from an underground storage tank by a Teesdale automatic transfer pump which is controlled by a Mercoid float switch. An emergency hand pump is incorporated as an integral part of the fuel transfer system. The fuel transfer pump installation was supplied by Preferred Utilities.

Fuel consumption of the SP Blackstone Diesel engine per brake horsepower hour is given as:

Grade A in pounds —	full load	.41
	¾ load	.42
	½ load	.45
Grade B in pounds —	full load	.42
	¾ load	.43
	½ load	.47

A forced draft radiator is used for heat exchange in the closed jacket cooling system. Warm air from the radiator is used to supplement the unit heating system in the sales room during cold weather and is bypassed to the areaway at other times. Jacket water temperature is limited between 140 degrees and 150 degrees by two Mercoid switches which operate the radiator fan. A hydrostat, also installed in the jacket water line opens a city water make-up valve when the jacket water temperature exceeds 150 degrees.

Intake air is supplied from the basement through a spun glass filter in the engine room wall. An American 12-E air filter and a Maxim intake silencer are mounted on the engine.

Exhaust is carried under the floor to a Maxim silencer outside the engine room, then to the atmosphere through a high stack.

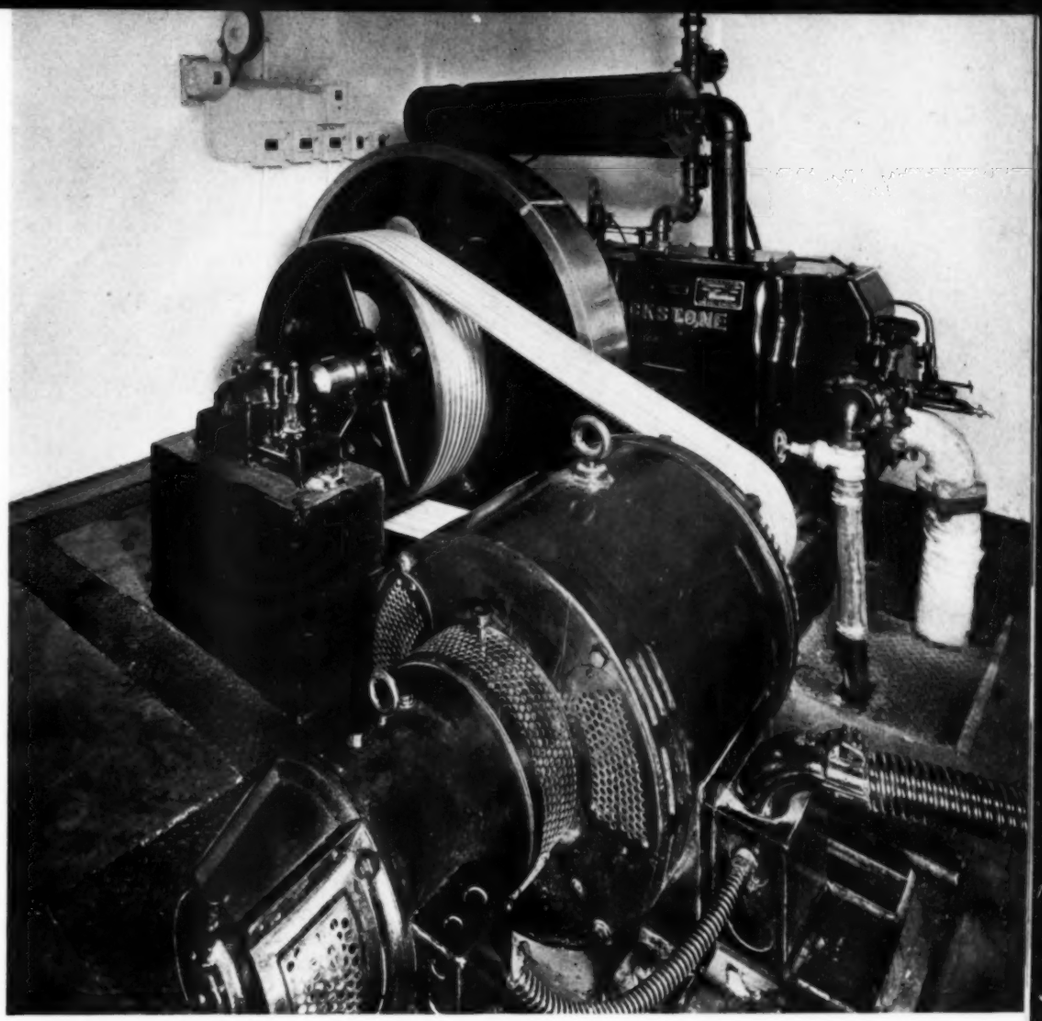
The engine and generator are mounted on a Vibration Eliminator cork sub-base which effectively isolates the plant as to vibration. Sound isolation, equally as effective, was accomplished by building the engine room walls of gypsum blocks with a hanging ceiling constructed of Johns Manville Sanacoustic tile. A standard self-closing fire door and a small vestibule, constructed of celotex board renders the plant practically inaudible. In fact, neither sound nor

vibration can be detected at any point in the store with this power plant operating in the basement directly under the rear of the sales room.

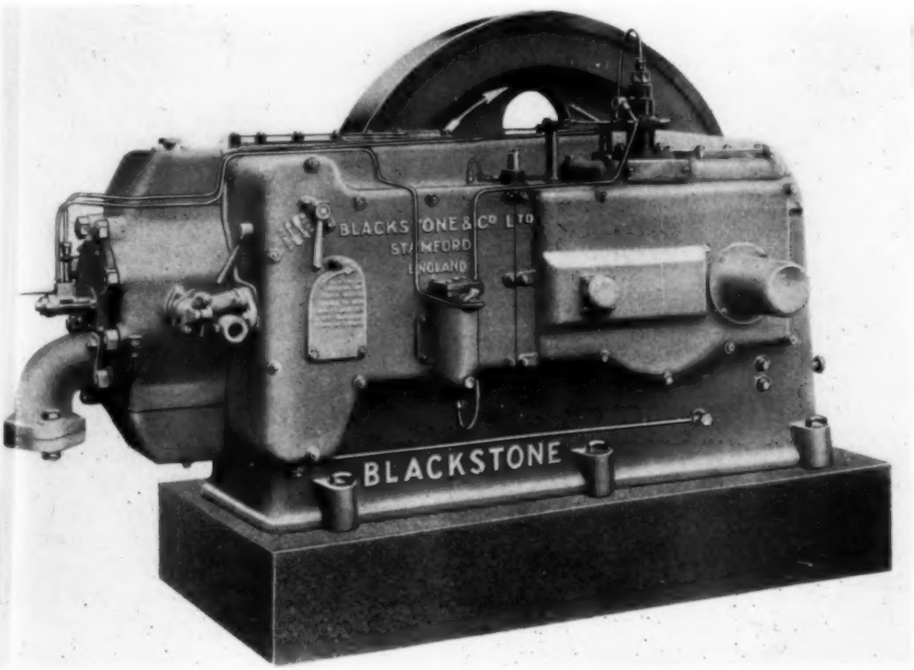
The generator has the familiar Star built-in automatic voltage regulator which is capable of voltage control on all three phases to within a small margin of total voltage. This voltage regulator has no moving parts or tubes and its control is effected from a pilot circuit produced by a built-in current transformer, the primary winding of which forms the neutral connection of the alternator. The generator frame is designed for lightness and strength, being built up of welded steel plates with attached perforated plates which act as guards and ventilators.

The switchboard was designed and constructed by the Seaboard Electric Co. It carries Weston ammeters for each of the three phases, a Weston voltmeter with voltmeter switch, a single throw knife switch, generator rheostats, and voltage regulator and a Sangamo watthour meter. The switchboard panel is made of ebony asbestos.

This Diesel generating plant is operating fifteen hours a day, six days a week. The normal daytime load is from 22 to 25 kw., while the evening load reaches a maximum of 30 kw. Operation continues after store closing hours, for show window illumination, until 11 P.M. when the plant is stopped by an automatic time switch. This type of operation brings the average load factor down to 66⅔%, under which conditions the average output has been 10 kw. per gal. of fuel.



Above: — Engine room view with Star alternator in the foreground. Note the American filter and Maxim silencer which handle the intake air directly from the engine room.

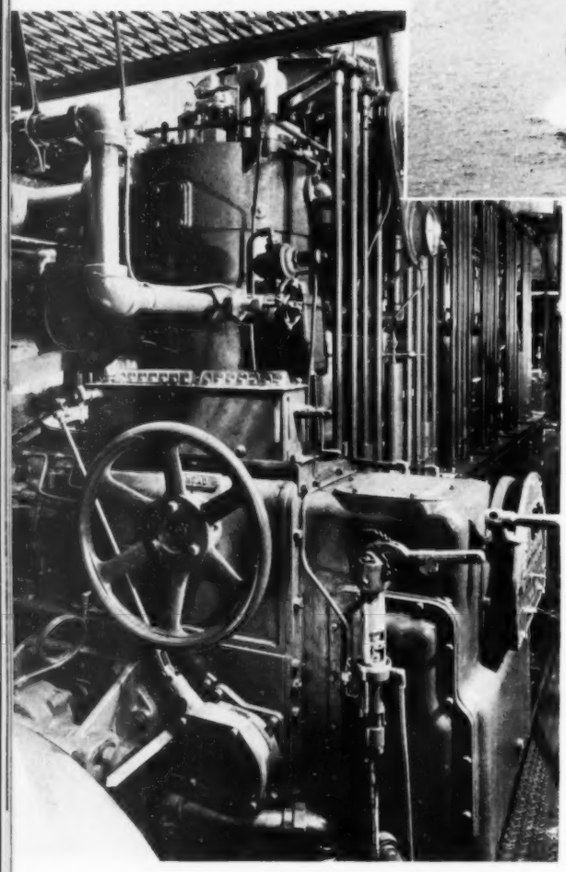


Below: — A shop view of the SP Blackstone Diesel engine in which the governor and valve mechanism are totally enclosed.

A 20 kw. standby connection is maintained with the utility lines with an automatic cut-over which functions in the event of engine shutdown. Annual savings in lighting costs are estimated at $2,800 and further savings will be realized as a result of supplementary heat supplied by the power plant.

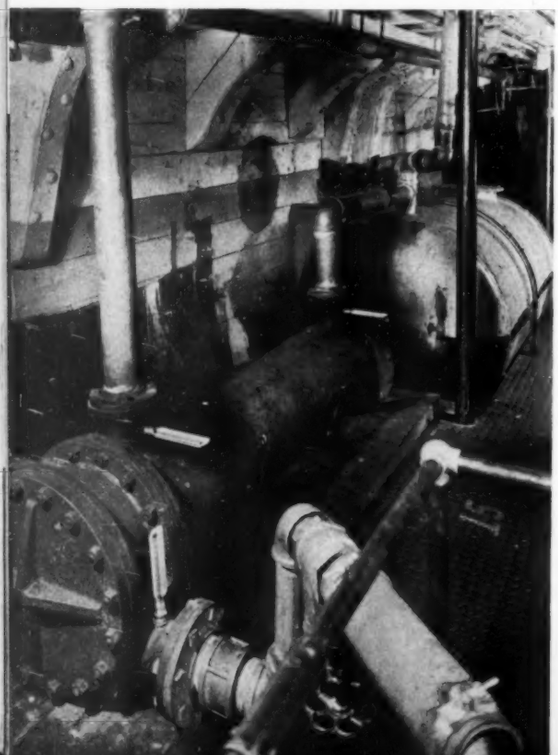
Compressed air for engine starting is secured by exhausting the engine compression back into a storage bottle after the engine has attained a speed sufficient for the kinetic energy of the flywheel to carry over for eight or ten revolutions. This arrangement eliminates the usual auxiliary air compressor. Thus air for subsequent startings is available after the original hand starting.

The power plant was designed by Peet & Powers, Inc., American sales representatives for Blackstone Diesel engines, and installed by The General Diesel Power Corp.



The tug "Harry R. Conners" goes back into competitive towing service with a new 500 hp. Atlas Diesel engine.

This Condenser Service heat exchanger was constructed with bolted heads to render the interior easily accessible.



DIESEL TUG "HARRY R. CONNERS"

By GEORGE D. CROSSLEY

BUILT at Greenport, L. I., in 1919 for steam propulsion, converted in 1929 with a Standard, 6-cylinder, 330 hp., high speed Diesel engine, driving through a reduction gear, and lately reconditioned by the Conners Marine Company at North Bergen, New Jersey, this sturdy wooden hull is again ready for many years of heavy towing service. Her registered dimensions are 81.4 feet length, 21.3 feet width, and 9.9 feet depth.

The *Harry R. Conners* is now powered with a new 6-cylinder, 4-cycle, 14½ in. bore by 18 in. stroke, direct reversible Atlas Diesel engine, developing 500 hp. at 285 rpm.

This forty-one ton engine was installed directly on the normal engine bed without vibration isolation and, through the entire speed range, there is no noticeable vibration at any point in the boat from pilot house to stern.

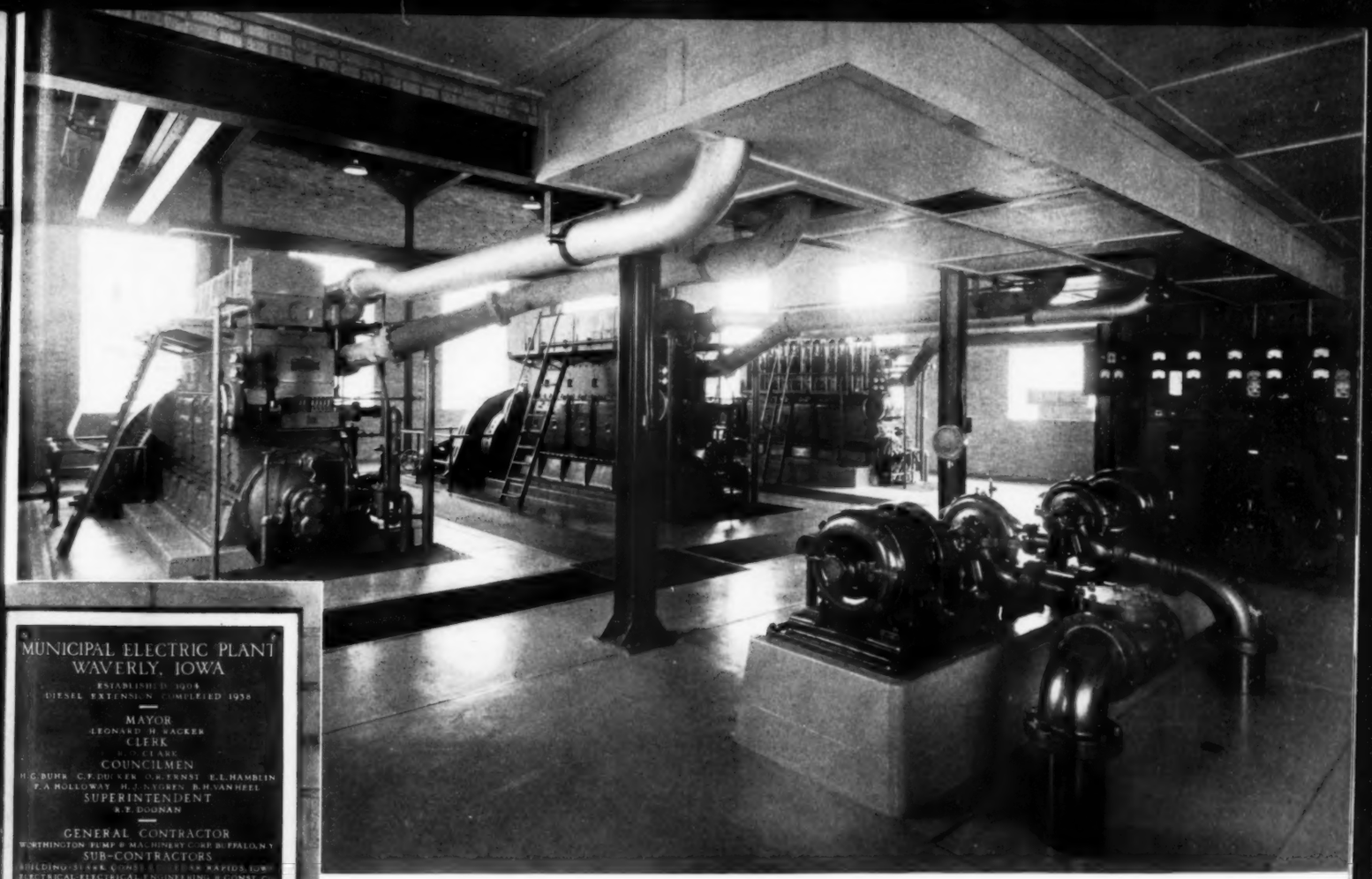
Equipped with a single lever control and air brake operating on the flywheel, the engine is manoeuverable from full ahead to full astern in three to four seconds. Further evidence of the flexibility of this engine is the fact that during trials, idling speed was cut down to 67 rpm. with the engine turning over smoothly.

A built-in compressor supplies air for engine starting and for the steering air motor. The injection system is the common-rail type, of Atlas manufacture. The closed fresh water jacket cooling system is equipped with a built-in circulating pump, a Condenser Service heat exchanger, and a Weinman centrifugal sea water pump.

A Maxim MSC-1 spark arrester type exhaust silencer is mounted vertically in the stack. A six point Alnor exhaust pyrometer is mounted on the instrument panel on the engine room bulkhead aft. Fuel and lube oil day tanks are installed on the grating forward.

Exhaust and water connections are Atlantic flexible metal hose. Fuel oil and lube oil filters are twin Purolator. A Schutte-Koerting lube oil cooler completes the engine accessories. A 32-volt, DC generator, belted to the engine flywheel supplies charging current to a bank of Gould storage batteries used for lighting.

The tug, *Harry R. Conners,* completed her trials in the North River, New York, April 18th and went into service the evening of that day, having been signed up for the movement of upwards of one hundred barges. This towboat is typical of many of her vintage that could be repowered with Diesels and reconditioned for profitable service.



General engine room view of the Diesel extension to the Waverly, Iowa, Municipal Electric Plant.

WAVERLY, IOWA

By C. M. STANLEY*

ONE of the most modern and attractive Diesel plants in Iowa is now serving the City of Waverly. This 1110 kw. plant placed in service in 1938, supplements a 500 kw. hydro-electric plant on the Cedar River and supplies the Municipal system. The Diesel equipment is installed in an addition to the existing plant, which serves as the headquarters for the Municipal Utilities of Waverly. Within this one building are now located the hydro-electric generating plant, the Diesel generating plant, the water works pumps, meter test room, garage, store room, and offices.

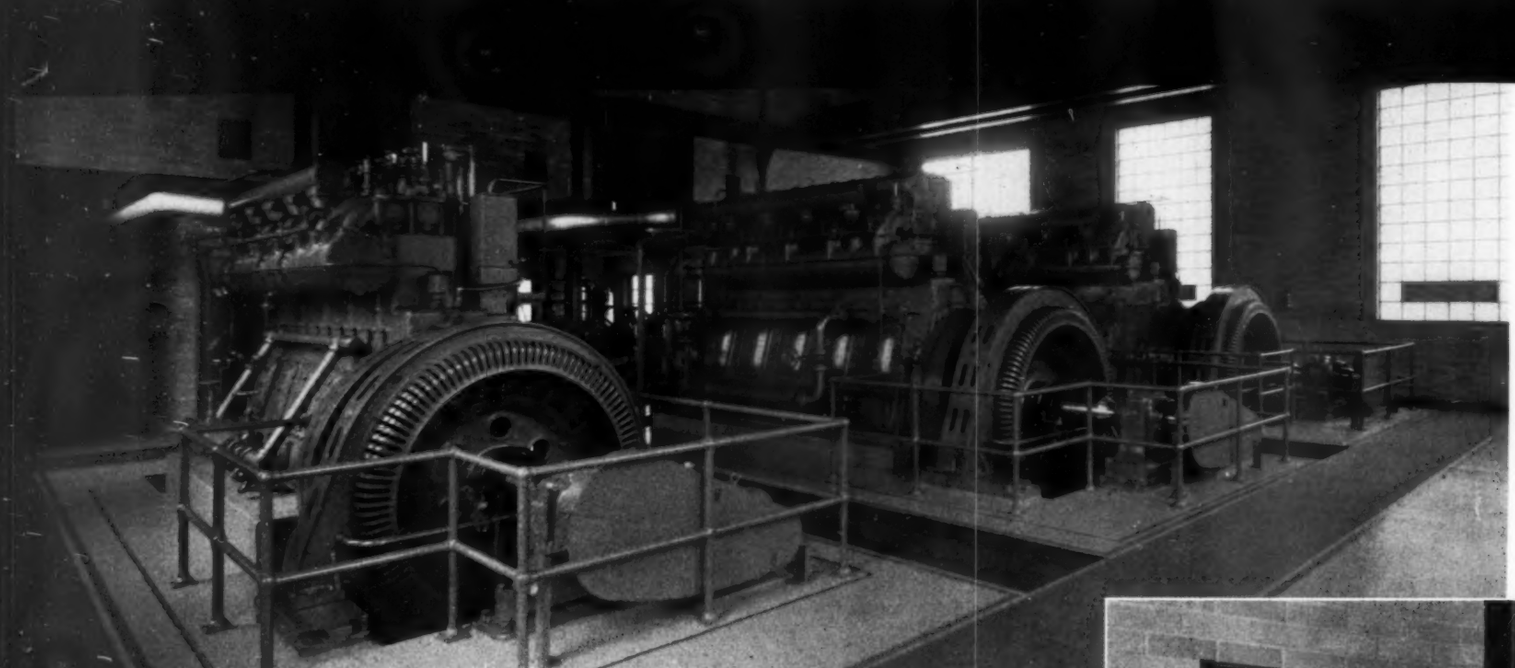
The City of Waverly, population 3,650, is a prosperous county seat in the rich, agricultural area of Iowa. The major industries of the city are those usually associated with an agricultural area and include a canning plant and milk processing plant. Waverly has long owned and operated a municipal electric system with a hydro-electric generating plant located on the east bank of the Cedar River. A dam across this river provides an 11 ft. head and three generating units, having a total capacity of 500 kilowatts, are installed.

At the time the extension was considered, the system required 2,500,000 kwh. per year and had a maximum demand of 840 kw. with normal peaks of 750 kw.

This plant does not have sufficient capacity to carry the peak demands of the municipal system. The flow of the Cedar River and, hence, the plant output, are extremely variable. The plant however, has a potential output of over 2,000,000 kwh. per year, based on average river flow. In order to meet the need of additional capacity over the peaks and to offset the deficiency of the hydro generation at times of low river conditions, Waverly has, since 1918, purchased power from a nearby utility. They have sold their dump hydro power to the same company at a low rate.

Consideration was given to the installation of additional generating equipment when the pur-

*Young & Stanley, Inc., Engineers, Muscatine, Iowa.



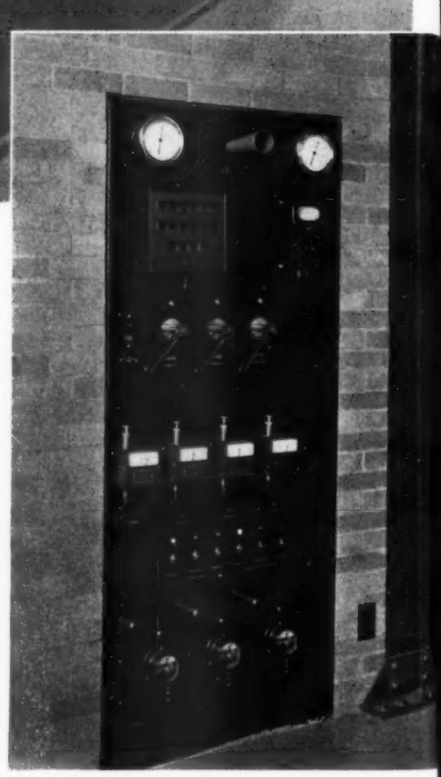
Above — Two 625 hp. Worthington Diesels in the foreground and one 375 hp. Worthington Diesel in the background. Note Shaw Box 5-ton hand-operated traveling crane serving all three engines.

chase agreement expired. Thorough investigations and studies were made by Young & Stanley, Inc., Engineers, of Muscatine, Iowa, and a comprehensive report was presented to the city officials covering the various possibilities of supplementing their hydro-electric plant. These studies indicated that the cost of installing and operating generating equipment would about equal the present cost of purchasing power and would effect a saving with increased load. Over a 20-year period, the estimated average annual cost of purchasing was $40,700, as compared to $33,900 for operating and financing a plant. It was expected that some decrease in rates could be obtained which would narrow the margin between generation and purchase. It was believed, however, that in any event the generation would be slightly less expensive over a period of years.

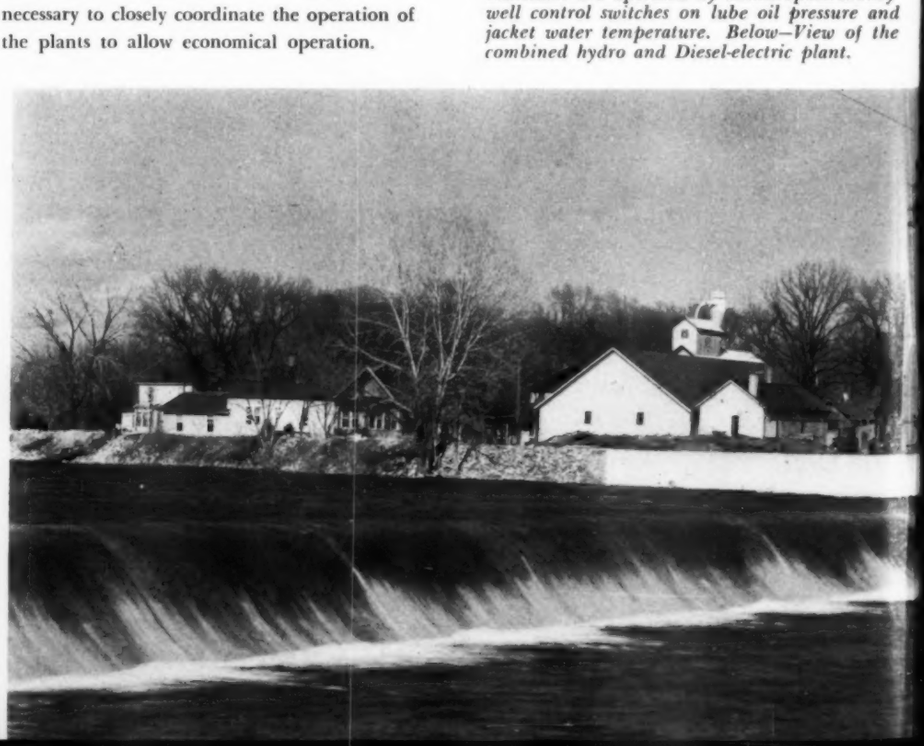
One of the other factors that led to the construction of the Diesel generating plant was the feeling that improved service could be obtained by having all of the generating equipment, upon which the city depended, located within the city limits and thus avoid interruptions to service resulting from transmission line difficulty. A third reason that entered into the decision was the desire of the city officials to provide their community with self-sufficient generating equipment so that they would have full control over all of the steps involved in the operation of the municipal utilities and would be independent of private utilities.

The presence of the hydro plant imposed several rather unusual design features not ordinarily encountered in the Diesel generating plants. In the first place, the plant had to be designed with sufficient capacity to take care of the maximum load of the city at those times when the flow of the river was low and little help could be obtained from the already underrated hydro-electric plant.

Secondly, the operation of the hydro-electric plant meant that the annual generation of the Diesel equipment would be low. The most economical operation of the system obviously results by generating the maximum possible output with the hydro-electric plant and using the Diesel equipment to supplement this when necessary. This means that the annual capacity factor of the Diesel plant is low and, also, that during many hours of the year, the Diesel plant must carry less than 150 kw. Thirdly, it was necessary to closely coordinate the operation of the plants to allow economical operation.



Above—Signal panel with Brown exhaust pyrometer. The Benjamin Howler and Edwards annunciator are operated by Minneapolis-Honeywell control switches on lube oil pressure and jacket water temperature. Below—View of the combined hydro and Diesel-electric plant.



Studies were made of various types of generating equipment. It was apparent that additional hydro-electric equipment would not be satisfactory as it would not overcome the present problem of lack of generating capacity at times of low water. Comparative studies of steam and Diesel indicated a considerably lower cost for Diesel under the particular conditions which existed.

In order to care for the maximum capacity, a total installed capacity of over 1,000 kw. was required, with the largest unit not more than 500 kw., which represented the capacity of the hydro-electric units. In order to provide flexibility of the plant, a three unit plant was desired with one unit small enough (200 to 250 kw.) to operate efficiently on the many hours of light load. The equipment installed included two units of 430 kw. each and one of 250 kw. In order to coordinate the operation, the Diesel plant was installed as an addition to the existing plant, so arranged as to facilitate each communication between them and so that one set of operators could take care of both types of equipment.

The old building included space for the hydro-electric generating units, water pump, air compressors for air lift pumps on the water system, office, meter testing room, garage and store room. All of these facilities are retained in the rearranged plant and, in addition, facilities are provided for the new generating equipment. A basement is provided along one side of the Diesel room to accommodate the auxiliary equipment. The addition to the plant is entirely of fireproof construction with reinforced concrete footings and foundations, and with a superstructure having a steel frame and brick walls. The roof is a steel deck with suitable insulation and roofing supported on roof beams. Foundations for the generating units rest on wood piling driven to rock and consist of individual concrete blocks for each of the Diesel-electric units.

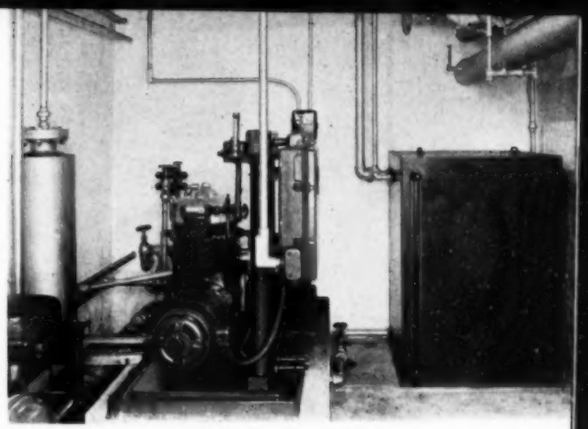
The architecture of the building is simple, yet pleasing, in appearance and has been achieved at a very nominal cost. The exterior is a dark red face brick with limestone trim. The interior has a smooth, buff colored brick. Glass block is used in all openings. Ventilation is provided with roof ventilators and forced draft fans with cool air entering screened louvers built into openings in the glass block. The engine room is heated by air circulated around the exhaust silencers with blowers. The offices and meter test room are connected to the existing steam heating system which takes care of the City Hall, adjoining the plant, and the balance of the building.

Generating equipment consists of two 625 hp., 16 in. x 20 in., 5 cylinder, 327 rpm. Worthington, Type EE, vertical Diesel engines direct-connected to two 430 kw. generators; and, one 375 hp., 5 cylinder, 13¼ in. x 17½ in., 327 rpm. Worthington, Type D, vertical Diesel engine direct-connected to a 250 kw. generator.

All generators are Electric Machinery Mfg. Co. and operate at 2,400 volt, 3 phase, 60 cycle, 0.8 Power Factor. Each of the units is provided with a separate exciter driven from the extension shaft of the engine by a chain belt.

Intake air is taken from the attic of the building, where three intake filters are provided, and is conducted to the engines by overhead pipes. The attic serves as a large silencing chamber and satisfactorily eliminates any objectionable noise. The exhaust silencers are also located in the attic and are likewise connected to the engines by overhead pipes. Fans are provided for the circulation of air around the silencers. This hot air is then forced into the building and used for heating the plant.

A cooling water system for the engines is a closed one. Raw water is obtained from the river water above the dam, flows through the heat exchangers, and is discharged below the dam. A twin strainer is provided in this line



Goulds Hydroil lube oil reclaimer and collection tank.

and a pump is installed for use in emergencies, although, under ordinary conditions, the water will circulate by gravity through the heat exchangers.

The soft water system has three circulating pumps located in the basement and connected to headers. The water flows from the pump through the engines and the exchangers to an outdoor sump tank from which it is picked up by the suction side of the pump. A water softener of the zeolite type conditions the jacket cooling water.

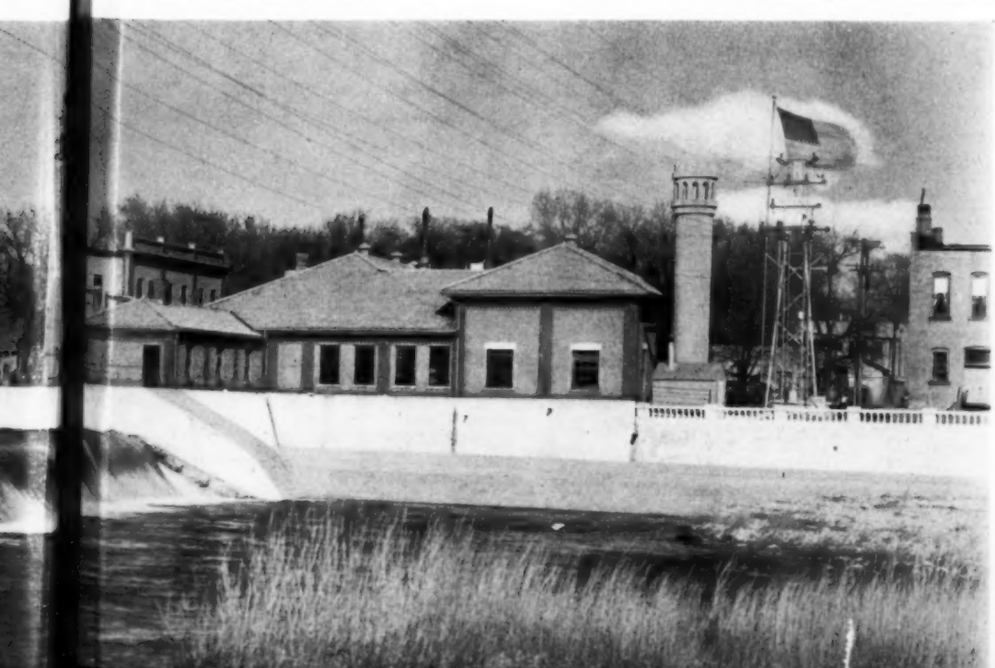
Fuel oil is unloaded at the railroad siding approximately three blocks from the plant and is pumped into vertical storage tanks having a total capacity of 24,000 gallons. Oil flows by gravity to the basement of the plant, where it is centrifuged and stored in a 2,000 gallon underground tank. Fuel is transferred from this tank to the day tank by the transfer pump, with suitable arrangements for valving and metering the oil to each unit.

A Goulds Hydroil is provided in the basement with the necessary tanks for storage and handling of lube oil. The batch method of purifying is employed, with oil flowing by gravity from the engine crankcase to the centrifuge and returned by a small transfer pump.

A dual driven air compressor, with necessary starting tanks, is provided for starting the Diesel engines.

The centrifuges, cooling water pump, transfer pump, air compressor, and tanks are all located in the basement, and all piping is in the basement. The size of the basement is such that a very neat arrangement is possible which affords ample clearance for working around all the auxiliary equipment.

A new switchgear was provided to control the outgoing feeders, the hydro-electric generators, as well as the new Diesel generators. The



The eleven panel, cubicle gear, General Electric switchgear with high voltage wiring enclosed in a steel compartment and rheostats installed in attic above the switchgear.

switchgear is an eleven panel, cubicle gear, with all high voltage wiring and apparatus enclosed in a steel compartment. Each of the generators is provided with an individual voltage regulator which is mounted on a framework back of the switchgear. The rheostats for all of the generators are mounted in the attic above the switchgear. All of this makes a very clean-cut and neat appearing arrangement. All wiring and control is in conduit and most of it is placed in the concrete slabs and walls, or on the basement ceiling and walls. Electrical work includes a system of alarms for the engines and gives warnings of high temperatures, low pressures, etc., on the important auxiliary apparatus.

The Waverly plant has several unique features which are worthy of further mention, even though they have been briefly mentioned in the description of the plant. These features include the following:

1. Appearance of the plant.
2. Location near business district.
3. Connection with hydro-electric plant.

The most striking impression that one obtains of the plant is its good-looking appearance which has been obtained from a well planned building superstructure that is sufficiently large to give ample space around the equipment; and from the careful attention to the elimination of piping and other unsightly items from the engine room. Although the building is very neat and attractive, the architectural treatment is neither ornamental nor elaborate. The lines and details of the building are simple and plain and a pleasing appearance has been obtained without unnecessary expense. The attractiveness of the building is further emphasized by the extremely orderly manner in which the plant is being maintained.

The second feature is that this plant is located only one-half block off the main business street of the city: thus it is closely adjacent to high-priced property. Many Diesel plants, which have been operating for a number of years, are located close to business districts, but whenever a new plant is considered, questions are always raised as to the wisdom of a site close to the business or residential districts. The Waverly plant is free from any trouble with vibration or noise. This was accomplished by special precautions taken in the design of the foundations and the selection and arrangement of silencing equipment. The results obtained at Waverly indicate that a quiet plant, free from vibration, can be obtained if careful attention is given to the design of the plant.

A third unique feature is the coordination of the hydro-electric plant with the Diesel equipment. Plants having such a combination are not plentiful and are particularly unique in the Middle West States. Under the present load conditions at Waverly, the majority of the power required for the city is generated with the hydro-electric units and the Diesel plant is required to act as reserve equipment and to make up for the deficiency of hydro-electric capacity and to operate over the peaks. The extreme flexibility of the Diesel generating equipment, together with the short time required for starting and placing the units on the line, makes it very adaptable for use in supplementing the hydro-electric units.

Bids for the construction of the power plant extension were received on October 19, 1937, and a contract covering the entire project was awarded to the Worthington Pump & Machinery Corp. This company subcontracted the building to Stark Construction Co. of Cedar Rapids, Iowa, and the electrical work to Electrical Engineering & Construction Co., of Des Moines, Iowa.

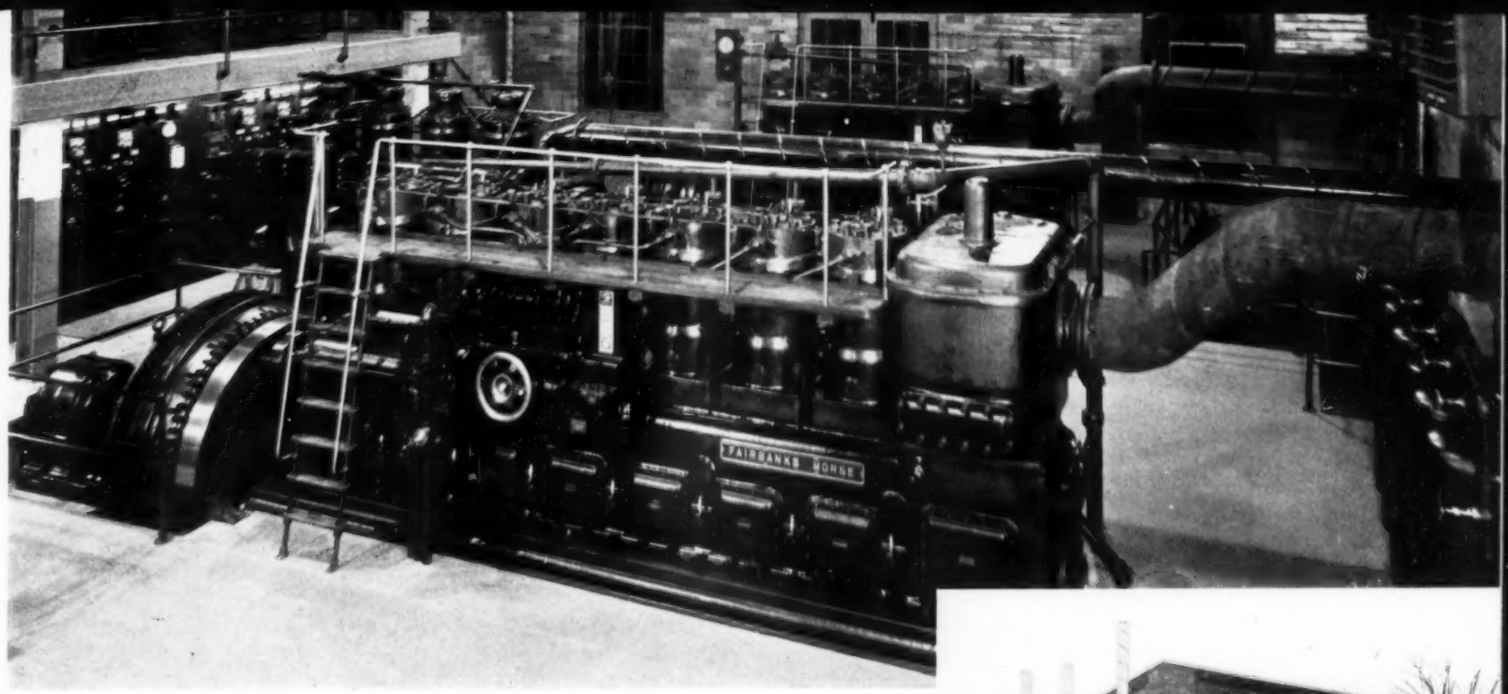
Construction work on the project started soon after and the plant was completed and ready for preliminary operation in May, 1938. Acceptance tests were run June 17 and 18, 1938, and the plant was soon thereafter formally accepted for the city.

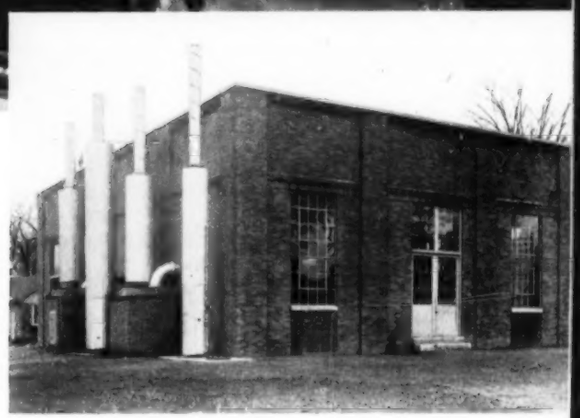
The plant was financed in part by the issuance of $100,000 in revenue bonds which are payable out of the future earnings of the plant. These bonds mature over a 10-year period. The balance of the cost was taken care of out of cash on hand which had accrued from profits of the Municipal Electric Plant.

The Municipal Utilities of Waverly, Iowa, are operated under the direction of Mr. R. E. Doonan, Superintendent. The operating personnel, under Mr. Doonan's guidance, has given very careful attention to the maintenance and operation of this plant. The plant is kept "spic and span" and freshly painted at all times, presenting a very pleasing appearance. The same type of attention given to the appearance of the plant is likewise given to the maintenance of the equipment and the details of operation. As a result, the plant presents a very attractive and businesslike appearance.

While the plant has been in operation for less than a year, it has definitely indicated that the cost of operation will be less than that assumed in studying the proposition. During the eight months period, from July 1, 1938 to April 1, 1939, the Diesel plant generated 757,300 kwh. out of a total generation of 2,336,00 kwh. The Diesel engines thus generated only one-third of the total output which meant that the average capacity factor on the Diesel plant was very low. However, the output of the plant averaged 11.44 kwh. per gallon of fuel oil. This high economy results from the careful attention given by the operating personnel and the extreme flexibility of the plant. The operation so far has fully justified the installation of a three unit plant with a small unit particularly fitted to take the light load that must be carried to supplement the output of the hydro-electric unit.

The project was constructed under the supervision of the City Council of Waverly, Iowa, during the regime of the following city officials: L. H. Racker, mayor; R. O. Clark, city clerk, and R. S. Doonan, superintendent. All engineering work in connection with the project was done by the firm of Young & Stanley, Inc., Engineers, of Muscatine, Iowa, under the supervision of the writer.





Top view shows general engine room with the recently added Fairbanks-Morse 805 hp. Diesel engine in the foreground. Underneath is an exterior view showing two Maxim Type BRM intake silencers mounted on filter houses and two Maxim DO4 exhaust silencers mounted above exhaust pits.

DOWAGIAC, MICHIGAN

By R. D. CAMPBELL AND CLINT VOORHEES*

MARCH 29, 1939, was a red-letter day in the history of Dowagiac, Mich., for it marked the official opening and dedication of the new municipal Diesel power plant which did not cost the taxpayers one cent, brought lower electric rates to the citizens, and paid profits into the city coffers. The occasion also commemorated the golden anniversary of electric service and municipal water service to Dowagiac. While the city has enjoyed the advantages of municipal water service since August, 1889, and some municipal power business for several years, the recent celebration was occasioned by the installation of a new 805 hp. Fairbanks-Morse Diesel engine-generator unit and the completion of the new power plant building to house all the engines and equipment of both the water and light departments.

The newest unit, which was installed in January of this year, consists of one 7-cylinder Model 33D14, 805 hp. Fairbanks-Morse, 2-cycle, pump-scavenging Diesel engine direct-connected to a 705 kva. 3-phase, 60 cycle, 2,400-volt alternator, and a 15 kw., 125-volt direct-connected exciter which have a full load rating of 564 kw. at .8 power factor.

The inlet air is drawn in through an 18 in. Maxim type BRM silencer mounted on top of the air filter house. In the air filter house is located a group of eight 20" x 20" American Air Filter type OC units which remove dust and foreign matter from the inlet air. The air flows from the filter house through an 18 in. spiral welded steel pipe to the scavenger pump cylinder where it is compressed to a pressure of 1 to 1¼ pounds above atmospheric pressure. The air is then supplied through an air header to all working cylinders of the engine. The capacity of the scavenging pump cylinder is large enough to deliver approximately 30 per cent more air than the combined displacement of all working cylinders, thus insuring complete scavenging and recharging the cylinders with fresh air at a pressure slightly above that of the atmosphere. The exhaust from all working cylinders is collected in a water-cooled manifold and conducted to the exhaust pit in spiral welded steel pipe. From the exhaust pit, the gases pass upward through an 18 in. Maxim type DO4-2C exhaust silencer.

The pistons are oil-cooled, receiving oil from the pressure lubricating system which supplies the bearings and all moving parts except the outside of the pistons. The oil flows through the drilled crankshaft and connecting rods up to the under side of the piston crown. Upon return the oil is cooled by means of a Schutte-Koerting heat exchanger which receives cooling water from the same source as the cylinder jacket. The lubricating oil in the pressure system is regularly circulated by a built-in rotary type pump which is located in the crankcase of the engine. However, an electrically driven auxiliary oil pump is connected into the system and is used to circulate the oil just prior to starting the engine, so as to insure lubrication, and is also operated for a few minutes to cool the pistons after the engine has been stopped. The engine is of the wet sump type, having a crankcase capacity of 185 gallons of oil. All oil from the main bearings, connecting rod

*Clint Voorhees, City Engineer and Superintendent of Public Works, Dowagiac, Michigan.

bearings, and moving parts within the engine base is allowed to fall into the crankcase. The portion of the oil which is used for piston cooling is filtered and cooled before it is returned to the crankcase sump. All working pistons and the scavenging pump guides are lubricated from a Madison-Kipp force-feed lubricator. Each working cylinder is lubricated at three points, and the scavenging pump guides are lubricated above and below the scavenging pump piston. The lubricator is supplied with oil from the main circulating system which maintains a constant level of oil in the lubricator reservoir at all times.

The plant contains four other engines which have been installed during the past fifteen years. The smallest engine is a single cylinder, 50 hp., Fairbanks-Morse type Y, style V, which runs 257 rpm. and is belted to a 6 in. Fairbanks-Morse Figure 800N centrifugal pump. This engine and pump were installed in 1924, to supply water to the city.

At the same time that the above engine was purchased, the city purchased a 4-cylinder, 200 hp. engine of the same type which was direct connected to a 170 kva. alternator. This unit was used to supply electric current for some motor driven pumps, the street lighting system, and a few customers. Both of these engines were purchased on a time payment contract, the payments to be made from savings accruing from the use of Diesel power instead of steam or purchased power. This equipment was paid for out of savings in a period of four years, and is still a part of the plant equipment in good operating condition.

The success of the first two engines and the growing demand for municipal power caused the city to seek means of increasing the plant capacity. In 1933, an application was made to the PWA for a loan and grant totaling $160,500 to increase the distribution system, build a new plant building, and add more Diesel engines. On December 31, 1935, the city received notice of the approval of its application, and on February 20, 1936, an election was held which authorized the issuance of revenue bonds in the amount of $115,500 to cover the loan. The grant was for $45,000. The election carried by a majority of over 3 to 2, but litigation and injunctions delayed any further procedure along this line.

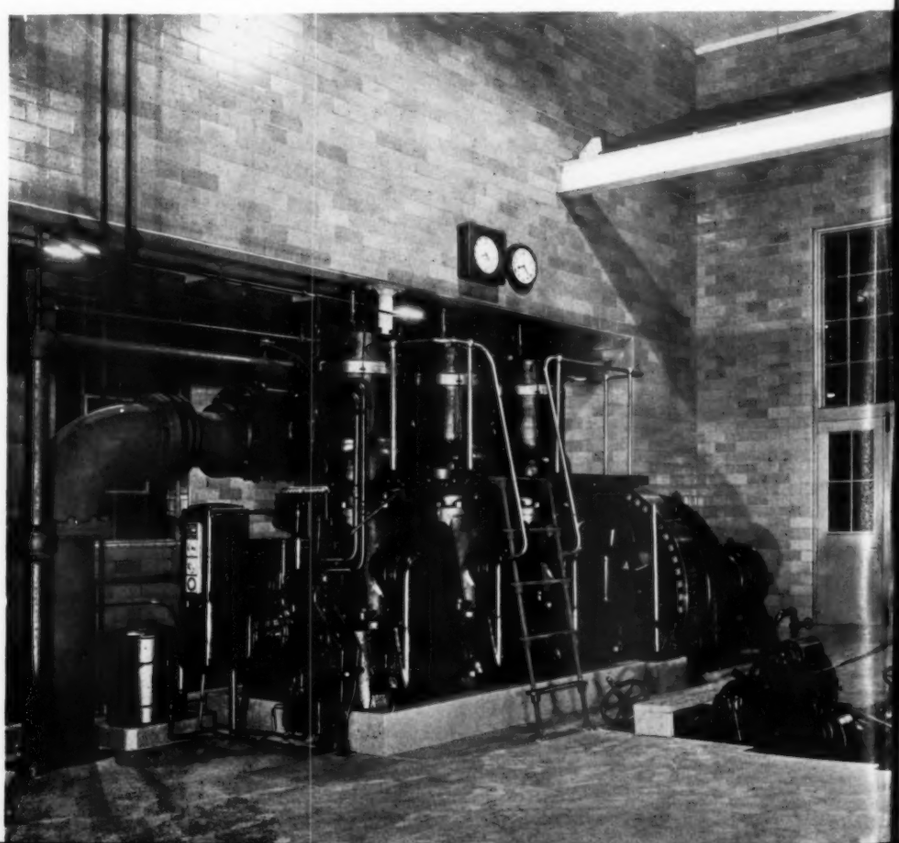
The injunction which was granted prevented the light department from installing additional equipment, but did not prevent the water department from taking action. Accordingly, the water department placed an order for a new engine late in 1936. The engine was installed in March, 1937, and consisted of one 3-cylinder, 225 hp., 300 rpm., Fairbanks-Morse, Model 32E14, 2-cycle, Diesel engine direct-connected to a 198 kva., 3-phase, 2,300-volt alternator, and a 7½ kw., 125-volt exciter. This unit had a full load rating of 148 kw., and had a much better fuel and lubricating oil economy than the earlier units. The installation of this unit insured complete stand-by service for the earlier engine supplying the electric driven pumps of the water department, and permitted the sale of electric current to a few additional customers. This unit replaced a small steam turbine which was not only inadequate but was expensive to operate.

The demand for municipal power distribution was growing so rapidly that before the above mentioned unit was installed, an order was placed for a fourth engine. The fourth unit consisted of a 5-cylinder, 575 hp., 300 rpm., Fairbanks-Morse, Model 33D14, 2-cycle, pump-scavenging type of Diesel engine direct-connected to a 490 kva. alternator, and a 15 kw. exciter. The full load rating of this unit was 392 kw. at .8 power factor, and the unit was placed in service on November 11, 1937. This unit, together with a 20-foot section of the new building, was purchased with revenue certificates maturing serially over a period of ten years. Here again, the engine manufacturer evidenced his confidence in Diesel power by accepting revenue certificates in payment for his equipment. At no time were general tax bonds issued to procure new equipment or facilities for the plant.

Cooling water for the heat exchangers is obtained from a water reservoir which was formerly a part of the city water supply system. The reservoir is 30 ft. in diameter and 20 ft. deep, being some 15 ft. below ground and extending 5 ft. above ground. The reservoir is fed by Artesian wells, and the water ranges in temperature from 50 to 70 degrees. The water from this reservoir is circulated to all heat exchangers and returns to the reservoir. No cooling tower is required by the plant. The engine room is heated by passing the engine hot jacket water through unit heaters equipped with fans to force the air circulation.

All engines are started by compressed air at 250 pounds pressure. There are two compressors, either of which is available for supplying the starting air. One is a 4½" x 4" Type AAA1001 Gardner-Denver single stage compressor driven by V-belts from a 7½ hp. Fairbanks-Morse electric motor. The second compressor is a two-stage Fairbanks-Morse, arranged so as to be driven by either a 3 hp. Fairbanks-Morse electric motor or a 3 hp. Type Z Fairbanks-Morse gasoline engine. The gasoline engine is for use in case of any emergency which might interrupt electric service in the plant. The compressors are located in the basement and supply the air to six 20" x 60" air tanks designed for 250 pounds working pressure and supplied by the Diesel Plant Specialties Com-

Two of the four engines installed during the last fifteen years: A 3-cylinder, 225 hp. and a single cylinder 50 hp. Fairbanks-Morse engine.



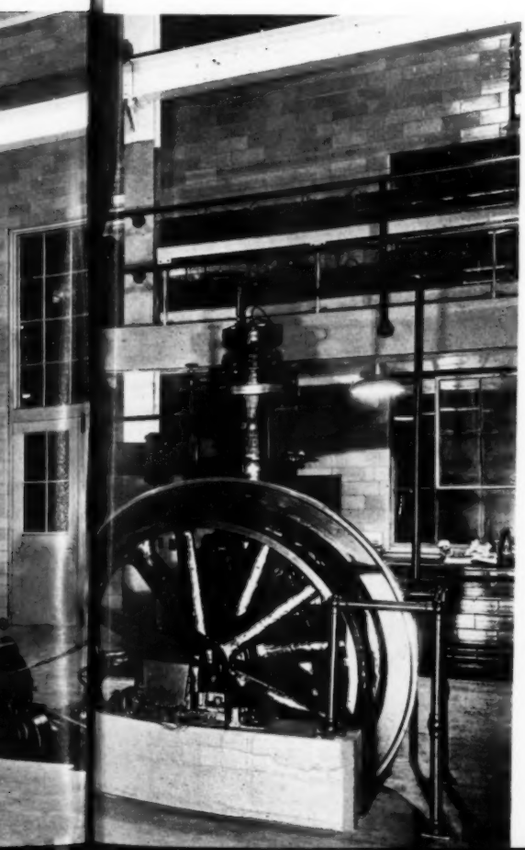
pany of Chicago, Ill. Each tank is fitted with a pressure gauge, and all tanks are connected to a common manifold.

The fuel used for all engines is a U.G.I. Michigan gas oil having the following properties:

Viscosity at 100°F.	40 – 45 SSU
End Point	720°F.
Gravity	32°Be

The fuel is stored in two horizontal steel tanks located directly behind the main plant building. The tanks are of 12,000 and 15,000 gallons capacity and are supported at an elevation of 5 feet above the ground by means of a structural steel framework. The fuel flows by gravity to day tanks supplying each engine. The fuel is filtered by Nugent Fuel Oil filters located on each engine. Each of the three newer engines is equipped with a Woodward Type IC isochronous governor, while the two engines installed in 1924 are equipped with the governors regularly supplied by the engine manufacturer at the time these engines were made. The plant is equipped with a 5-ton, hand operated hoist on a Chisholm-Moore overhead crane. The crane has a span of 43 ft. and travels the entire length of the main engine room, making it available for servicing any engine.

The switchboard is of steel construction, deadfront type, and consists of four engine panels and three distribution panels. Each engine panel is fitted with an AC ammeter, a DC ammeter, a kilowatt meter, and the customary synchronizing switches. The swing bracket is equipped with two AC volt meters, a DC volt meter, and a synchroscope. All instruments and equipment were manufactured by the Westinghouse Electric and Manufacturing Company. Voltage regulation is controlled by the new Silverstat Regulator which was also manufactured by Westinghouse. Each of the last two engines is equipped with a special panel containing an Alnor pyrometer and alarms for the lubricating oil and cooling water.



Besides the pump which is belt driven from the 50 hp. Diesel engine, there are located in the plant three electrically driven pumps for the city water supply. These pumps consist of two 4 in. Advance, double-suction centrifugal pumps delivering 750 gpm. at 155 foot head, and direct-connected to two 50 hp., 3-phase, 60-cycle, 2,400-volt, 1,800 rpm. Westinghouse induction type electric motors and one 5 in. Figure 875NE Fairbanks-Morse, double-suction, ball-bearing, bronze fitted, centrifugal pump rated at 1,000 gpm. at 155 foot head, and driven by a 60 hp., Type H, Fairbanks-Morse electric motor of the same electrical characteristics as the other motors.

These three pumps are located in the pump room which adjoins the main engine room but is some 4 ft. lower in elevation. The pump room is shown in the picture directly behind the 3-cylinder engine. No stand pipe or reservoir is used to supply the water mains, and, hence, at least one of the pumps is in operation at all times to maintain pressure on the city mains.

It is of interest to note that the city plans to keep the 50 hp. Diesel pump unit to protect the city in case of fire and to receive any concessions in fire insurance rates accruing from such duplicate source of water pressure. Any accident in the plant which might conceivably prevent the generation of electric power would not prevent the city from having an adequate supply of water.

Since 1935 the plant and the load have grown rapidly, culminating in the new engine, new buildings, and extended distribution system completed early in 1939. The growth in the load is indicated by the following figures:

Kwhrs. generated in 1937	765,000
Kwhrs. generated in 1938	1,400,000
Kwhrs. estimated for 1939	2,250,000

The books of the Board of Public Works are audited regularly, and the growth of the net profits of the lighting system, as shown by the auditors, reveal the following figures:

NET PROFITS

From	*To*	*Amount*
10-1-34	10-1-35	$ 813.19
10-1-35	10-1-36	1,409.77
10-1-36	10-1-37	4,134.02
10-1-37	10-1-38	5,869.38

These figures are true net profits, not merely the differences between receipts and expenses. Each department of the city government is charged for the power it consumes, and is likewise credited for any benefits the plant receives from it. Depreciation is charged against each item of the electric system property and equipment, the charges being made in accordance with the best accounting practice.

The fiscal year for the Board of Public Works begins October 1, and operation summaries are tabulated for each quarter. A typical three months' period is that of July 1, 1938, to September 30, 1938, inclusive, and shows the following allocation for the power generated.

Type of Account	*Kwhrs.*	*Sale price cents per kwhr.*
Consumer Accounts, Residential and Commercial	205,666	3.32*
Street Lights	42,609	2.50
Water Department, pumping	61,260	1.50
City Hall, Library, and Municipal Sales	3,301	2.50
Station Auxiliaries	25,783	
Line Losses, etc.	46,481	

*Average—see rates given below.

A bright future is predicted for the Dowagiac plant because (1) it is handled on a strictly business basis, (2) it has the support of the majority of its citizens, and (3) it has established rates which will be conducive to the greater use of electrical energy.

Residential rates	*Cents per kwhrs.*	*Commercial rates*	*Cents per kwhrs.*
First 30 kwhrs.	@ 6	First 45 kwhrs.	@ 6
Next 30 kwhrs.	@ 4	Next 45 kwhrs.	@ 4
All over 60 kwhrs.	@ 2	All over 90 kwhrs.	@ 2

This makes electric rates *30 per cent lower* than when the municipal plant started in 1933, and saves electric users *$30,000 per year.*

Dowagiac is a city of 5,500 population, located in southwestern Michigan. It is the home of several industries, one of the best known being the artificial fish lures which have long been known as "dowagiacs." The citizens take great pride in their community and are solidly behind the move for municipal power.

DIESEL AVIATION

DIESEL AIRCRAFT ENGINES IN FRANCE

By PAUL H. WILKINSON

The first in a series of articles written from the field in Europe

PARIS, May 15 – After a few days in Paris, one finds that there is a good deal of interest in the Diesel aircraft engine. At the air Ministry, those in charge of aircraft engine development are well aware of the need for the Diesel in France, since practically all the fuel required for aviation has to be imported. Likewise in the high-speed, marine engine field, a powerful, yet lightweight engine is in demand for their motor torpedo boats. Both of these requirements call for an economical and reliable Diesel in the 1,200 hp. to 2,000 hp. class.

A visit to the extensive Diesel research laboratories of the Air Ministry at Passy is quite a revelation. Here one finds the eminent M. Clerget in charge of the work in a large two-story building with ample facilities at his disposal. On the ground floor of the building are test benches for the various engines, while on the upper floors are the offices and the drafting room and a well equipped machine shop. The latest types of fuel testing and engine indicating apparatus were also in evidence.

Beyond a doubt, the *pièce de resistance* at Passy is the Clerget 16 H Diesel. At the time of the visit, one of these engines was on the test stand coupled to an electric motor which was driving it so as to run in its bearings prior to its homologation tests. The finish on this engine is excellent and with its aluminum and light grey finish, it is a most impressive piece of mechanism. Although the Clerget is a large engine, its well balanced lines and the neat arrangement of its accessories give it a particularly impressive appearance. Actually, its frontal area is only about 10.7 square feet, which compares very favorably with radial engines having 50 per cent more frontal area.

A demonstration given by M. Clerget with a single-cylinder test engine, embodying one of the cylinders used on his 16-H engine, showed that there was hardly any vibration between an idling speed of 300 rpm. and a maximum speed of 2,200 rpm. The acceleration is excellent and the fuel consumption is 0.39 lb. per hp. per hour which will be reduced in the full-size engine.

On the second floor, one saw the well equipped machine shop in which some of the parts were being produced, although most of them come from outside sources. Here, too, were various parts such as crankshafts and cylinders, the latter comprising a steel barrel with an aluminum alloy water jacket and a detachable cylinder head. Some of the Rateau turbo-superchargers specially built for these engines, were also to be seen. This type of supercharger makes a very compact, yet sturdy unit. It weighs 37 lbs. complete and its turbine develops approximately 100 hp.

M. Clerget was most co-operative and he kindly obliged with photographs of his latest engine. He estimates that the homologation tests should be completed in about two months' time. He is positive that his engine will develop in excess of 2,000 hp. for take-off and that it will be able to cruise at 75 per cent power output, or 1,500 hp., at an altitude of 16,500 ft.

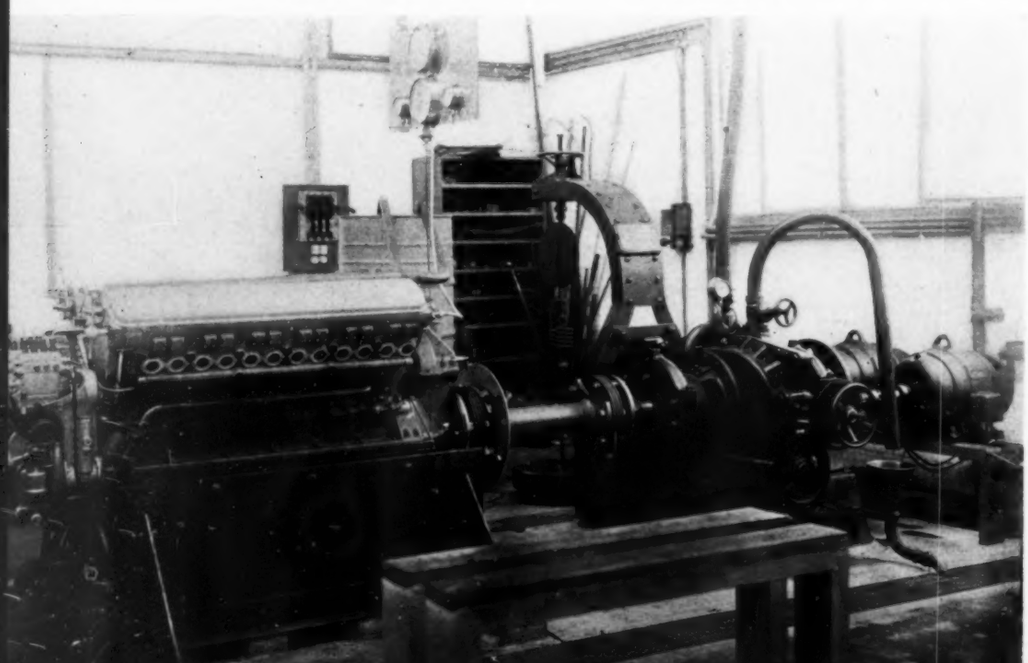
Although an invitation was extended to visit Orleans to see the flight testing of the Clerget 14 F-01 radial Diesel, time did not permit a trip to this center which is 150 miles from Paris.

On the opposite side of Paris, at the factory of Ateliers et Chantiers de la Loire, one found M. Jalbert and his Diesel aircraft engines. This is a large shipbuilding firm which specializes, among other things, in motor torpedo boats and submarines. At this establishment the 16-cylinder Jalbert-Loire 16 H Diesel aircraft engine was also on the test stand, while the designs for a 24-cylinder H-type engine were being rushed to completion. The last mentioned engine is to have a rated power output of 1,000 hp., with 1,200 hp. for take-off.

M. Jalbert is also completing the designs for a marine type Diesel which is to have 24 cylinders in *W* arrangement. It is expected that it will develop 1,100 hp. at 1,600 rpm. and that it will weigh approximately 6.6 lbs. per hp.

The cut-away view shows a typical cylinder assembly on a Jalbert-Loire Diesel. A close inspection of the fuel injection equipment reveals that it is of sturdy construction and that it gives particularly good results on a 4-cycle engine. The French Air Ministry is very much interested in the Jalbert-Loire aircraft Diesels and has already granted considerable sums for their development.

The construction of these engines is particularly interesting inasmuch as the crankcase is always maintained in compression by the action of through bolts which secure the cylinders to



View of the Coatalen 12 Vrs 2 Diesel on the test stand. It is to be tested under conditions simulating an altitude of 13,000 ft.

it. This involves the use of opposed cylinders but it appears to be well worth the effort. So far, supercharging has not been used on these engines and M. Jalbert is of the opinion that a b.m.e.p. of 115 lbs. per sq. in. can be obtained without recourse to it at a speed of approximately 3,000 rpm. He is taking, however, the precaution of supercharging all his engines in the future.

M. Coatalen has a number of enterprises in Paris and in addition to the development work on his Diesel aircraft engine, he also manufactures Lockheed hydraulic brakes, K.L.G. spark plugs and various other items. His Diesel aircraft engine is at his works at St. Cloud and it is being tested there under atmospheric conditions simulating those at an altitude of 13,000 ft. It runs very smoothly and with a clean exhaust.

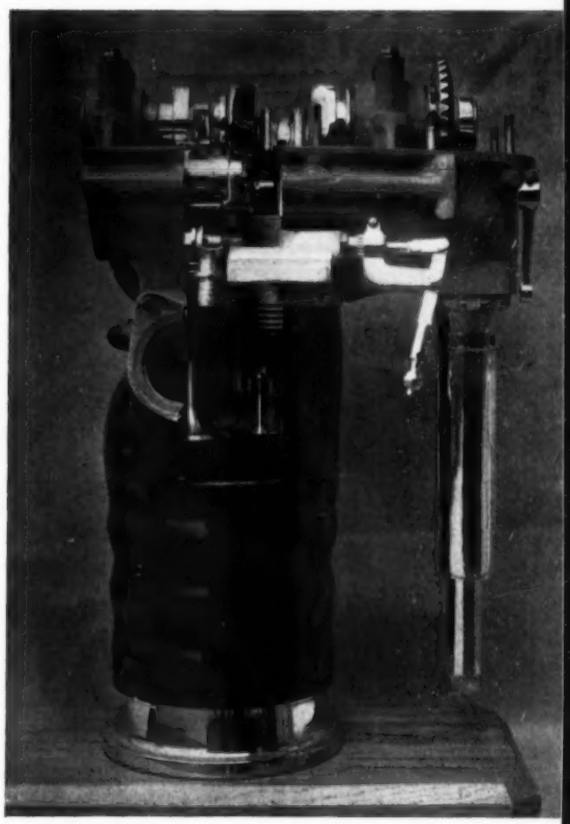
The latest project of M. Coatalen is the development of a 2-cycle engine to replace his present 4-cycle 12 Vrs. 2 Diesel. His new engine will have inlet ports around the cylinder walls and four exhaust valves in the cylinder head. It will be equipped with a turbo-supercharger and it is designed to develop 1,100 to 1,200 hp. at high altitudes. The weight will be approximately the same as that of the older engine; i.e., 1,212 lbs., and the same type of common rail fuel injection system will be used.

M. Delafontaine has designed a 7-cylinder, air-cooled radial Diesel aircraft engine which he expects to have completed in the summer. It operates on the 2-cycle principle and is equipped with a single-speed Farman supercharger which will give it an altitude rating of 400 hp. at 2,000 rpm. at 12,000 ft.

Another engine, which is approaching the test stage, is the Botali Diesel for small sport planes. It operates on the 2-cycle principle and is a 4-cylinder, air-cooled engine with a displacement type compressor for each cylinder for scavenging purposes. According to M. Botali, his engine will develop 100 hp. at 1,850 rpm. and will weigh approximately 2 lbs. per hp.

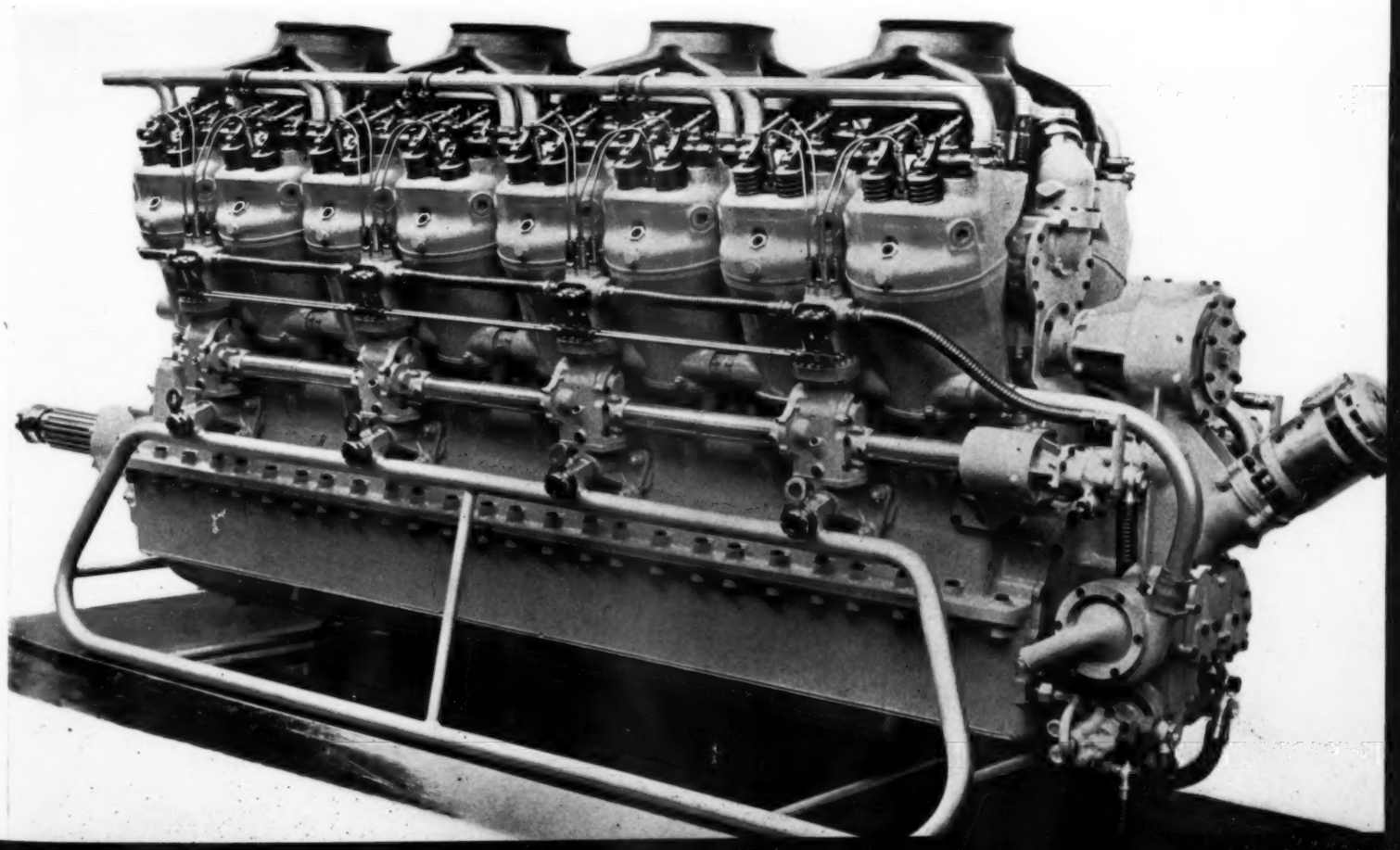
Compagnie Lilloise de Moteurs has moved from Paris to Tarbes which is approximately 360 miles away. Lack of time prevented a visit to their factory where they are busy on railcar and other engines built to their designs under Junkers license. The C.L.M. Diesel aircraft engine is still under development and engineering contact is being maintained with the Junkers factory.

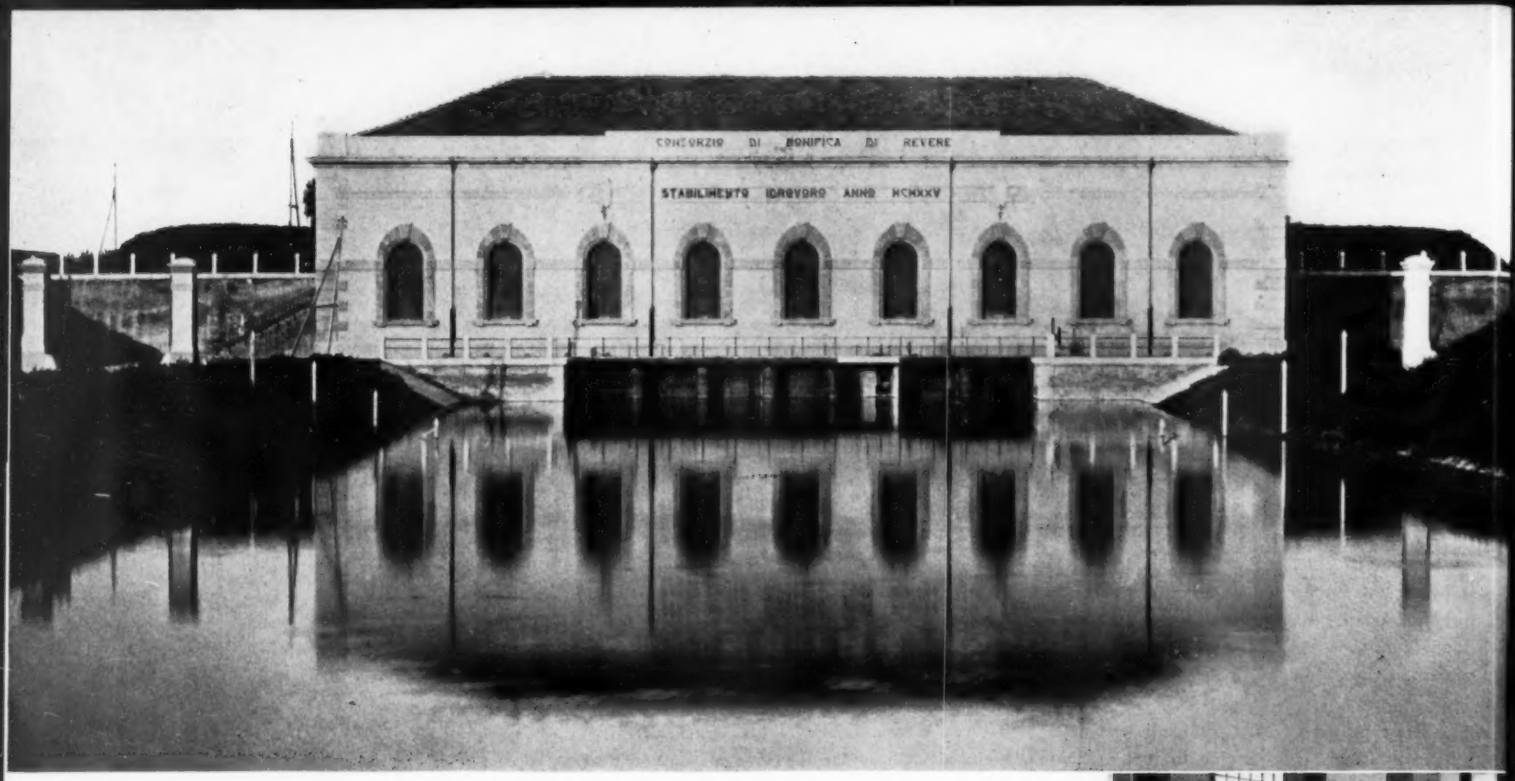
Mention should also be made of the Rochefort Diesel which has been developed in the form of a 2-cycle, opposed-piston engine with two crankshafts. It has six in-line cylinders which are air-cooled by an air blast from a special blower at the front of the engine. At present spark ignition is used but, in due course, the engine will be converted to full compression ignition.



Cut-away view of one of the cylinders of the Jalbert-Loire 16 H Diesel aircraft engine. Note the small fuel injector piston.

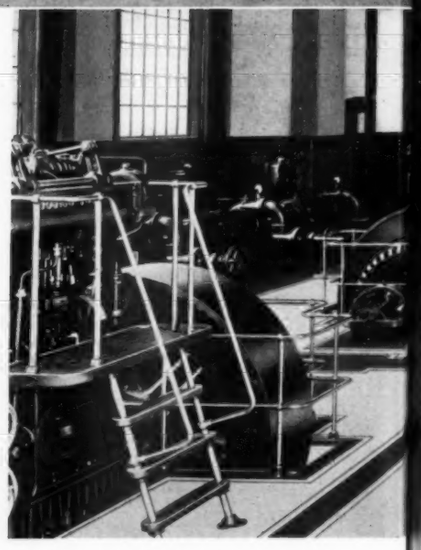
The new Clerget 16 H Diesel is now ready for its homologation tests. It is expected to develop more than 2,000 hp.





DIESEL IRRIGATION PLANTS IN ITALY

By ANTONIO GIORDANO

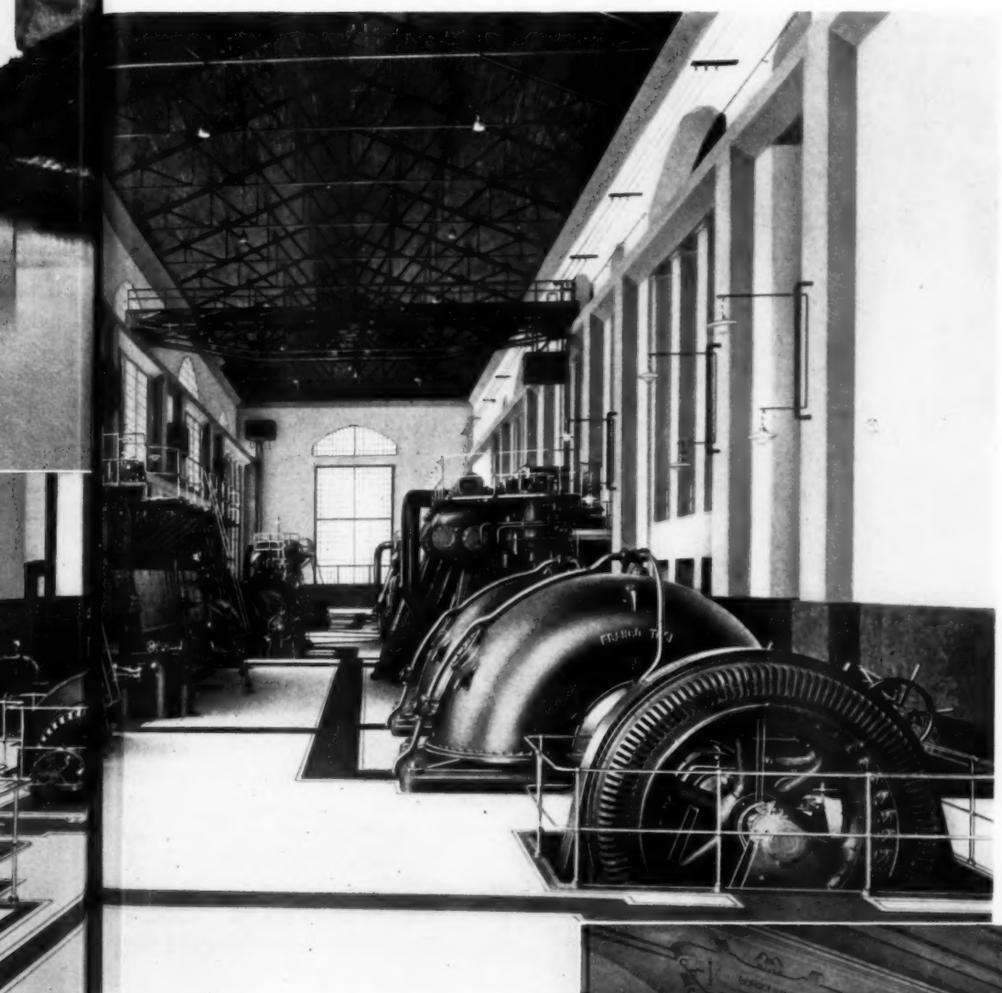


ONE of the most important problems which Italy has had to settle after reaching national unity; that is, within the second half of the previous century, has been the question of a reclamation project to be established in the marshes where malaria fever was predominant. The need was then essentially hygienic but the increase in population later added to this an economic problem in view of the necessity of land to be divided among the farmers and the vital necessity of a required increase in agricultural foodstuff. Thus, after several individual efforts to eliminate the waters from private grounds with somewhat rudimentary machinery, the government took up the question in order to co-ordinate the efforts in this field and to contribute in a large proportion the necessary expenses.

These works primarily were developed in the postwar period with great energy and perhaps more rational principles. In consequence, because of the altimetric conditions of the area requiring reclamation in Italy, part of which was lower than river level and, in some cases, even below sea level, the elimination of the waters has been effected largely by mechanical lifting plants. Since part of the work was handled by private individuals, large important plants have been built in Italy the first part of 1800. When the development of mechanical construction in industry originally began, it so happened that in Italy, as elsewhere, all types of motors and pumps were used. Plants were built with steam engines driving turbine pumps, or gas engines with centrifugal pumps — replaced later with Diesel engines and electric motors — and the more recent plants equipped with vertical propeller pumps driven either by Diesel engines or electric motors.

Experience has shown that the characteristics of propeller type pumps are superior to those of centrifugal types under varying prevalences encountered in drainage and irrigation service. While the maximum output of both types of pumps is practically identical, it has been found that the output of the propeller type pump is much higher than that of the centrifugal pump at prevalences above and below the optimum points of the pumps. Since the prevalence of the greatest period of operation during the year is considerably lower than that of the optimum point of the pumps, the propeller pumps effect material savings in the cost of electricity and fuel.

Left — The Consorzio di Bonifica di Revere plant at Revere, Mantova, with stabilizing reservoir in the foreground. Below — Interior of the Consorzio Interprovinciale per la Bonifica di Burana plant at Modena showing four 2,000 hp. Diesel engines.



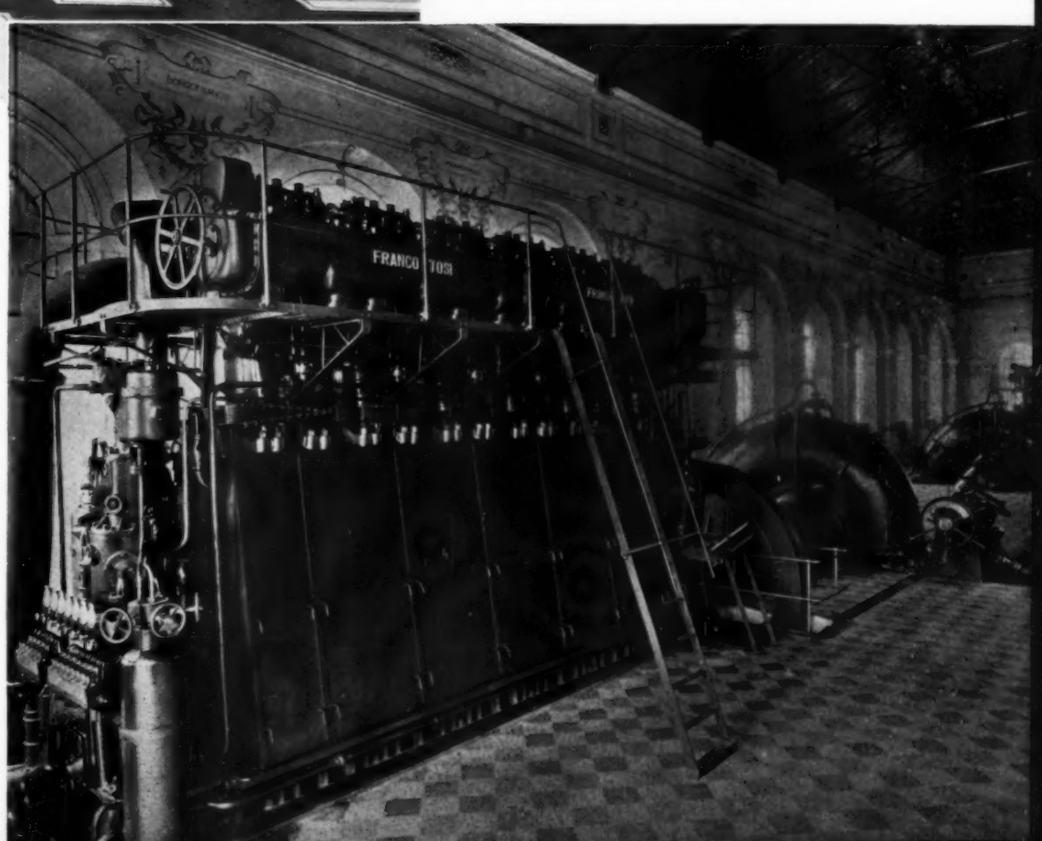
Typical of the present day combined reclamation and irrigation plants is the Consorzio di Bonifica di Revere at Revere-Mantova where there are three Franco Tosi 660 hp. Diesels direct connected to centrifugal pumps of 8 cubic meters per second capacity.

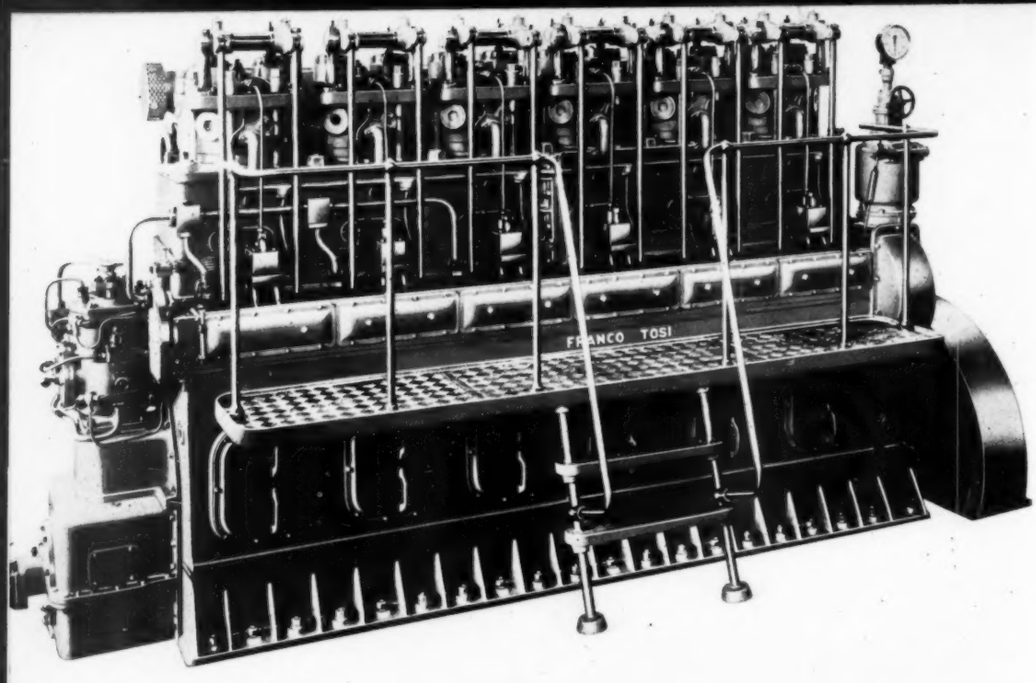
The use of electric propulsion machinery in these reclamation and irrigation projects has been retarded because of unreliable transmission and far distant electrical sources. The pumping plants must be available at all times and particularly in the rainy seasons because of the dependence of large agricultural areas on irrigation. Electric distribution lines have been extended, however, and improved so that electric motor drives have come into more general use, with Diesels for peak load and emergency standby. This combination of propulsion equipment satisfies the need for dependability and levels off the electric standby charges for irregular seasonal demands.

The powerful plant of the Pilastresi of the Consorzio Interprovinciale per la Bonifica di Burana is a fine example of the application of combined electric and Diesel pump driving equipment. This plant is arranged for either reclamation or irrigation. When the operation is on reclamation, the water from the reclamation channel is discharged into the River Po and when on irrigation, the water is taken from the River Po and discharged into the reclamation channel which distributes it to the ground. The pumps are Diesel-driven for reclamation service while for irrigation service the pumps may be driven by either Diesels or synchronous motors. The Diesel engines are 8-cylinder, 4-cycle, 480 mm. bore by 820 mm. stroke, and are equipped with Buchi type turbo blowers. Single slipper crossheads and liberally designed crankpin bearings greatly reduce unit pressures. The crankcase is independent of the piston chamber with open sub-frame which renders the interior of the engine easily accessible for inspection and repairs.

The pistons are oil-cooled through telescoping tubes. Cylinder head assemblies include intake and exhaust valves, as well as the Tosi patented

Interior of the Consorzio di Bonifica di Revere reclamation and irrigation plant showing three 660 hp. Tosi Diesel engines.





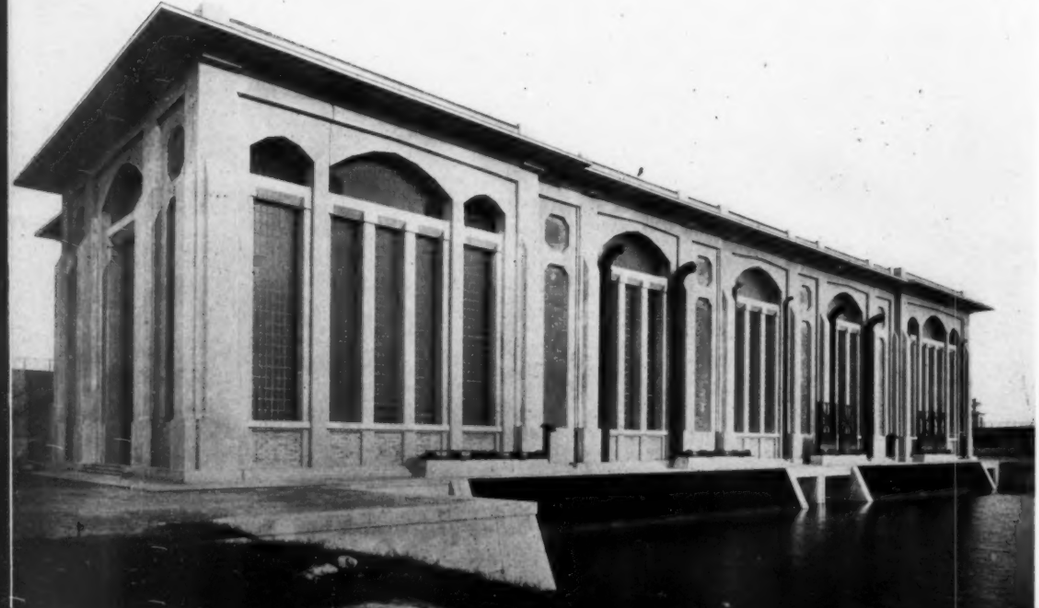
Shop view of Tosi 4-cycle solid injection 500 hp. Diesel engine.

fully enclosed injection valve. Air injection is used in these engines to adapt them for the use of lower grade fuels. Engines of this type, but equipped for solid injection, have recently been installed by Franco Tosi in the electric center at Asmara (Italian East Africa) and at Tripoli in Lybia.

Additional equipment at the Pilastresi plant includes two Diesel electric generating sets consisting of 360 hp. Diesel engines direct-connected to generators destined to supply electricity to other pumping plants, also two 90 hp. Diesel engines and three phase generators which supply electricity for driving the plant auxiliaries, such as engine cooling water circulating pumps, priming pumps, and gate operating motors. The auxiliary motors operate on three phase, 220 v., 42-cycle current and the main pump motors operate on three phase, 2,000 v., 42-cycle current. All Diesel engines and pumps were supplied by Messrs. Franco Tosi of Legnano, while the electrical equipment, including motors, generators, and switchboards, were supplied by Compagnia Generale di Elettricita of Milano.

In order to prevent reaction of the water on the pump, tending to drive the Diesel engines in reverse direction when the pump is stopped, a butterfly valve has been installed in each supply pipe. Automatically controlled gearing closes the valve when the pump speed falls below a certain level. The rate of closing is synchronized with the rate of pump deceleration by means of an oil brake. As the pump speed increases, the corresponding check valve is opened by oil pressure from the appropriate pump set.

Exterior view of the Consorzio Interprovinciale per la Bonifica di Burana at Modena — a combined reclamation and irrigation plant.



Recently another pumping plant was put into service — that of Cavanella Motte of the Consorzio di Bonifica of San Pietro di Cavazere. This plant includes two pumps driven by two asynchronous motors and two pumps driven by Diesel engines. The Diesels are Tosi 4-cycle, 6-cylinder, solid injection, 310 mm. bore by 450 mm. stroke, 500 hp. at 500 rpm. Pump drive is through flexible couplings and conical step up gears, the pumps operating at 610 rpm. These are vertical shaft propeller type pumps, also supplied by Franco Tosi. The electrical equipment and motors in the Cavanella Motte plant were supplied by Tecnomasio Italiano Brown Boveri of Milano.

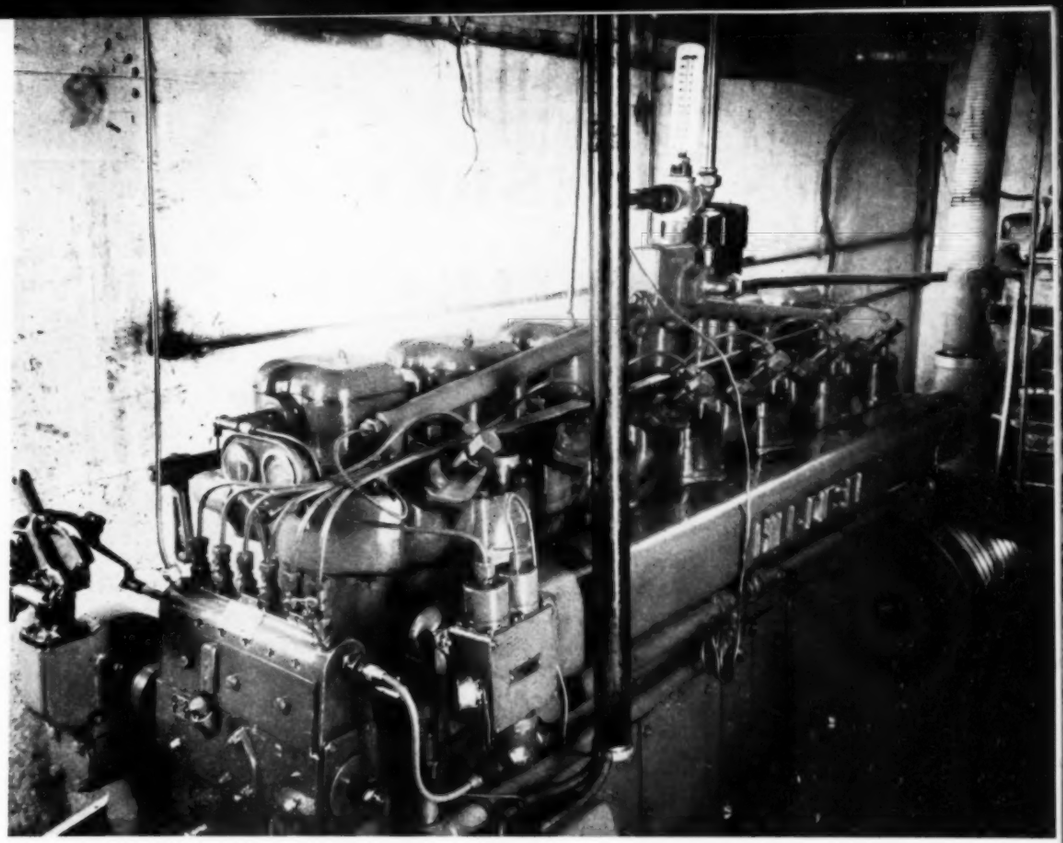
Recently completed is the Mazzocchio plant for reclamation of the Agro Pontio, Rome. This plant is built along lines similar to the Cavanella Motte plant, except that the pumps are electric motor driven. Seven propeller type, vertical shaft pumps designed for lifting water up to a prevalence of six meters and an output of 6,000 liters per second are directly driven by 510 hp. synchronous motors, at 330 rpm. The Franco Tosi Co. of Legnano, and the Riva Co. of Milano co-operated in building these pumps, while the motors were built by Compagnia Generale di Elettricita of Milano. The switchboards and fittings were furnished by Tecnomasio Brown Boveri of Milano.

The increasing use of propeller type, vertical shaft pumps and Diesel engines in recent reclamation plant installations is accounted for in the fact that they occupy considerably less space than the horizontal shaft centrifugal type with steam engines, and since these plants are generally located in marshy areas where foundation construction is costly, the conservation of floor space is a factor.

Thus, it is seen how Italy has vigorously attacked a combined hygienic and economic problem. By applying modern engineering skill and utilizing dependable Diesel prime movers, the fever infested marshes are rapidly being eliminated and new farm lands are being created through irrigation supplied by the same pumps.

CLEANING AND DYEING WITH DIESEL ENGINES

By B. J. VON BONGART



A 6-cylinder 75 hp. Hill Diesel equipped with a Pierce governor.

A MODERN cleaning and dyeing enterprise is a business that not only reconditions wearing apparel but also rugs and upholstered furniture.

Brown & Keller of Plainfield, N. J., have been established 45 years as cleaners and dyers, and in addition they maintain fur storage vaults to protect their clients' valuable furs during the summer months.

Such a business requires not only electric light but also power to operate the necessary machinery incidental to cleaning and dyeing processes, and the fur storage vaults need refrigeration by means of motor-driven compressors in order to maintain a vermin-proof low temperature within the vaults.

All of this calls for power and if the latter is purchased from a utility, the cost is rather high.

The firm of Brown & Keller produces its own current for lighting and power with a 75 hp. 6-cylinder Hill Diesel of the 4-cycle type, operating at a speed of 750 rpm. A 50 kw. Continental AC generator of 60 cycles is driven by multi-V-belts and delivers current at 120/208 volts for light and power.

The engine is equipped with an Air Maze air cleaner and a Burgess exhaust silencer. A Purolator filters the fuel oil and a W.G.B. filter reconditions the lubricating oil. A Pierce governor maintains a uniform engine speed and a Burlington voltage regulator maintains the proper potential. A Fulton-Sylphon alarm system gives warning should the engine performance fail.

The Diesel-electric plant embodies a Seaboard Electric switchboard with the necessary meters, and U.S.L. storage batteries, rechargeable from the electric system, are used for starting the engine. The installation is absolutely independent; no tie-in with a utility is provided for. A 2-cylinder Deutz Diesel engine, together with a generator, is used for standby services. This arrangement saves at least $40 per month and thus eliminates a useless expense.

The electricity used in this business would cost approximately $230 per month if metered by a public utility. The operating costs of the dual Diesel-electric plant are but $30 per month, and the savings amount to a round $200 per month — thanks to the Diesel engine.

With yearly savings totalling $2,400 per annum, the Diesel-electric plant pays for itself in about two years, and after that, it will be a source of net income to the operators for years to come.

DIESELIZED INDIAN IRRIGATION

By VAL WILLIS

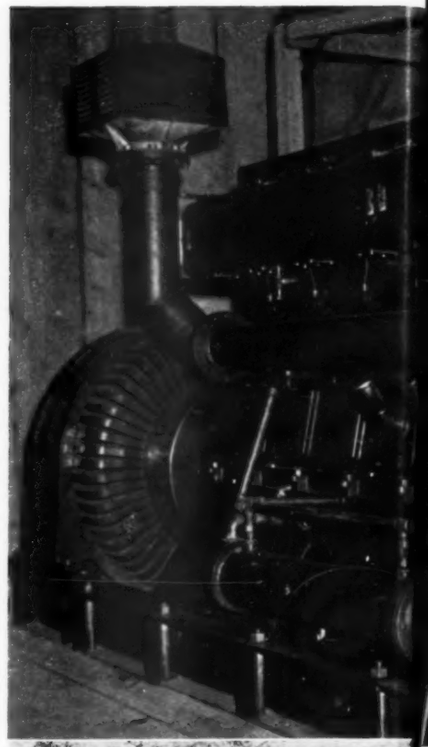
ABOUT one mile from Parker, Arizona, on the Colorado River, the Rohl-Connolly Company is building a large project known as the Headgate Rock Dam, originally started by the Mojova Indians in the year 1870. They, too, realized that if it were humanly possible for them to convey water from the Colorado River to their valley, their land would become fertile and productive. They began, therefore, by digging a narrow canal from the river to their reservation in the desert.

Imagine digging a tunnel through Headgate Rock with nothing but perhaps some crude shovels and picks made from flint rocks. This Rock, a great piece of granite, changes the course of the Colorado River and, in prehistoric days, the flow of water gradually wore the striking profile of a human head at the peak of this huge monument of nature's artistry. When the flow of the Colorado River was diverted around Headgate Rock, a unique tunnel entrance of rough construction, built by the Indians 70 years ago, was exposed. This feat of native Indian cunning is certainly worthy of permanent record. The opening of this tunnel had to be below the normal water level of the river to insure water for their canal when the flow was at low ebb. The rubble masonry, which faced the outlet of the tunnel, came to view when Rohl-Connolly Company built a coffer dam from the rock to the opposite bank of the river, diverting water to the other side.

My study of this project began by asking questions of everyone in the vicinity while taking photographs of the machinery and also the dam construction. I find that the equipment on this job is all new and of the latest development in modern dirt-moving machinery. There are four Diesel shovels, three 80D 3½ cu. yd. Northwest, powered with 6-cylinder MD6X 160 hp. Murphy Diesel motors, and one Koehring shovel Model 801, powered with Buda LD1742, 194 hp. Diesel motor with a 2½ cu. yd. Esco Manganese dipper.

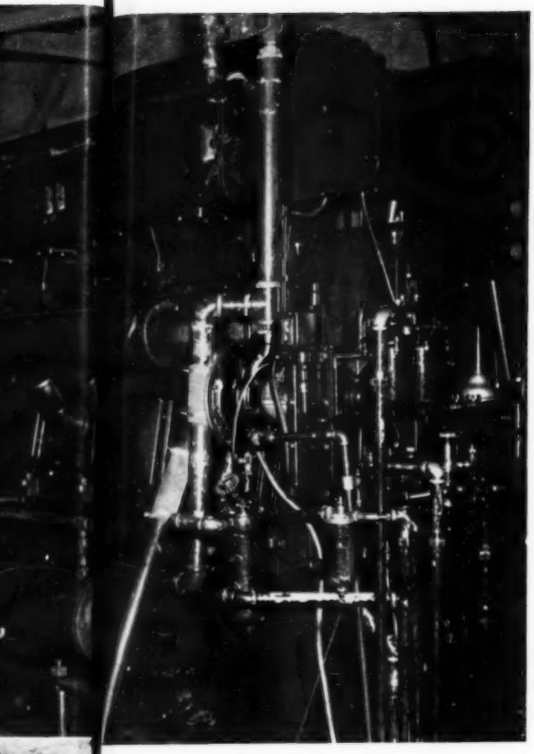
They are using eleven Sterling Dual Chain, Model HC285HB, four-wheel drive 20 cu. yd. dump trucks equipped with Cummins 150 hp. 6 cylinder Diesel motors, 24 volt Leece-Neville starter and generators, Donaldson twin oil bath air cleaners, and Stewart Warner motor mile recording tachometers. Since these trucks have a low gear, or rather a low low gear of about 200 to 1, the motor mile tachometer is quite important in determining the correct number of comparative miles these motors actually have traveled. On very short hauls, the motor miles will run as high as 25 to 1 over the speedometer mileage. A novel, as well as effective, accessory is the Cunningham fuel dehydrator. This little tank holds about one gallon and is filled with composition plates similar to battery plates. The tank is on the fuel feed line between the fuel tank and the motor and as fuel flows over these plates, water and acid is removed and drains into a sump to be drawn out when inspected at regular intervals.

While standing there I timed the loading of



The tunnel entrance, built by the Indians seventy years ago and exposed by the change in the course of the Colorado River, is shown above.

View showing Headgate Rock, the center of Headgate Dam. Note the appearance of a human profile, sculptured by Nature, at the top of this huge granite rock.



Above — This Superior Model J.S. eight-cylinder 350 hp. Diesel engine with a Westinghouse generator produces the electric power for the construction of Headgate Rock Dam.

the Koehring shovel. It has a 2½ cu. yd. bucket and from the instant the truck backed up to the shovel to the second it was ready to pull away, the time required was 1 min. and 11½ sec., which is considered very good loading speed. Then my interest in these huge trucks made me go still farther and I timed truck No. 89 from the moment it pulled away from the shovel until it returned again. The time was 9 min. and 4 sec. for a round trip distance of one mile, with an average grade of 9 per cent, thus making the complete truck cycle 10 min. and 15½ sec. Certainly, no other piece of machinery could possibly have made such fast time. As they are below river water level, they have quite a distance to pull in mud and water and, in places, a foot or better to go through before getting upon the ramp. But the Diesel trucks travel right along with no hesitancy whatsoever.

Beginning the excavation work on August 20, 1938, this contracting firm has experienced all extremes in climate and earth formations. Two months of extreme heat, where government thermometers registered, at times, over 120 degrees, were the real test of both equipment and man-power and, since all machinery is Diesel-powered, this extreme heat did not cause any loss of efficiency. These Diesel trucks and shovels, however, are not robots and require human beings to man them. These far-seeing contractors again turned to Diesel power to protect their men from the Mojova desert heat. A completely air-conditioned camp was built with one or more air-cooling units in each building. A Diesel-powered electric plant was installed with a Superior Model JS, 8 cylinder 9 in. bore x 12 in. stroke 350 hp. Diesel motor direct-connected to a Westinghouse generator, 294 kva., 2,400 volts, 71 amperes, which furnishes power for the electrified camp, sand and gravel plant, water pump, and all other camp utilities. A Caterpillar Palmer Diesel motor generator set is a standby unit.

This modern equipment has proven its worth by concrete results in yardage and satisfied workmen. To date, over 3,000,000 cu. yds. of sand, granite, and temple bar have been excavated since August 20 — a lot of mucking for six months' work in anybody's desert.

One of the eleven Sterling dual chain dump trucks, powered with 150 hp. six-cylinder Cummins Diesel engines, working in mud and water below the river level, is pictured below.

DIESELIZED DAIRY FARM

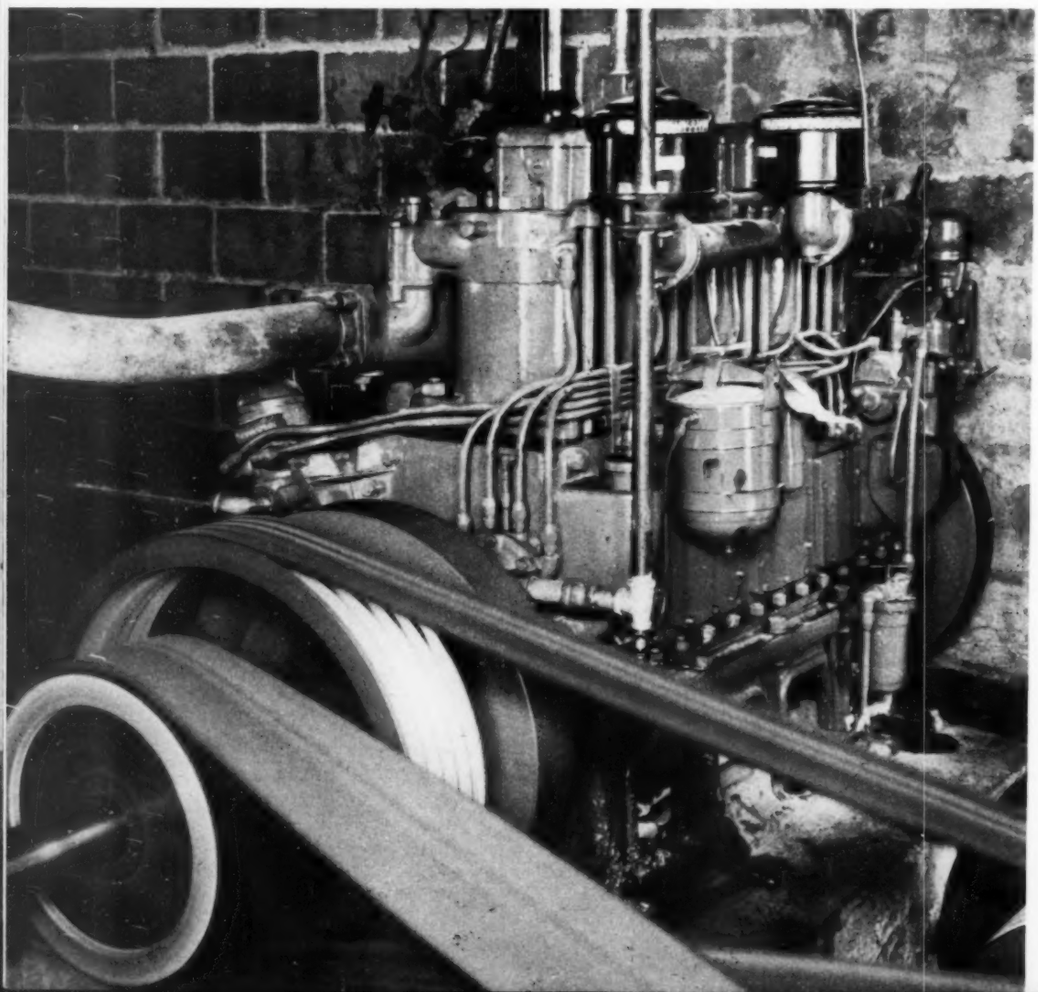
By B. J. VON BONGART

A DAIRY wishing to place a healthy quart of milk on the market and maintaining a 70 per cent Guernsey milk (Guernsey cows produce approximately one-half the quantity of milk of Holsteins), then overhead costs must be pared to the very minimum.

The Maple Hill Dairy Farms of Woodbridge, N. J., have a herd of 200 cows, 140 Guernseys and 60 Holsteins. They have been successfully established in the dairy business for 31 years and enjoy an enviable reputation for distributing high quality milk.

A dairy requires not only electric light but also power for the milk clarifiers and pasteurizing machines, for the bottle washers and fillers, for the water pumps and for refrigeration. Since the power requirements are extensive and thus costly, the management of the Maple Hill Dairy Farms decided some 20 years ago to produce their own electricity by means of a Diesel engine. No sooner had this been done than a utility approached the owners promising "real low cost electricity" if the owners would discard the Diesel engine.

High pressure salesmanship won; out went the Diesel and in came the utility current. The owners discovered that the "low priced" current that was promised to them totaled no less than $250 per month. Two electric stoves consumed an additional $30 worth of electricity per month, or a total of $280 per month for light and power.



This went on for eleven years, but proved to be altogether too expensive to continue. Thus, in 1936, the operators of the Maple Hill Dairy Farms again installed a Diesel-electric plant, a single cylinder Fairbanks-Morse. The faithful service rendered by the Diesel engine and the immense savings in power and light costs over a period of years induced the owners to install a new engine, a Hill 4-cylinder, 4-cycle Diesel 5 x 7, delivering 30 hp. at 650 rpm.

The engine operates a 6-ton ice machine, a 20 kv-a. Fidelity AC generator, a Fairbanks-Morse air compressor and a feed mixer are driven from the line shaft. The engine runs continuously for 150 hours. Then the oil is changed and another uninterrupted run of 150 hours begins. The engine receives but 15 minutes of attention per day, in reality just a minute check-up. Since the total operating costs for fuel and lubricating oil amount to but $50 per month, the net savings accruing to the management of the Maple Hill Dairy Farm total $230 per month, or, stating it in another form, the Diesel-electric plant pays for itself in less than two years.

THE UNIVERSITY OF MICHIGAN INVITES YOU

THIS YEAR the Oil and Gas Power Division of the A.S.M.E. will be the guest of the University of Michigan at Ann Arbor. Those who attended the previous meeting at Ann Arbor will remember the delightful Michigan campus. The facilities of the Michigan Union, which is the men's club on the campus, have been increased since the last meeting so that ample living accommodations as well as space for the various technical sessions and the exhibit are now available in the one building. This will make possible a unity of the group which could not be arranged before.

The program of five technical sessions, the inspection trip to the General Motors Diesel engine plant in Detroit, and the banquet have been so arranged that guests will have an opportunity to visit many of the instructional and recreation facilities available in Ann Arbor.

Be prepared for both indoor and outdoor sports. There are two swimming pools, a large number of tennis courts, and the University golf course, which is one of the best in the country (green fee 50 cents). There are several other good courses available also. There are scenic spots, such as the Arboretum and the Forestry Farm, for hikes or drives.

REGISTRATION

The registration headquarters will be on the second floor of the Michigan Union near the exhibits and meeting room. Upon arriving, however, go directly to the desk on the main floor where you will be assigned your accommodations.

PROGRAM

MONDAY, JUNE 19TH

1. Oil and Gas Engine Practice in Great Britain, by A. K. Bruce, London, England.
2. Resumé of European Design of Internal-Combustion Engines, by Monsieur M. Bochet.
3. High-Speed Diesel Engine Development in U. S., by C. G. A. Rosen and C. R. Maxwell.

TUESDAY, JUNE 20TH

4. Joint Use of Diesel Engines and Utility Power, by Edgar J. Kates, New York City.
5. Where Does Interpretation Begin?—Analysis of Oil Engine Power Cost Report, by Prof. P. H. Schweitzer.
6. Factors Affecting Design and Materials, by J. M. Dodge, Double Seal Ring Company.
7. Wear of Diesel Engine Cylinders and Rings, by Paul S. Lane, American Hammered Piston Ring Company.
8. Notes on Piston Rings and Cylinder Wear, by D. D. Cook, Cooktite Ring Sales Co.
9. Rings from the Operators' Viewpoint, by Stuart Nixon, Sealed Power Corp.

WEDNESDAY, JUNE 21ST

10. Stability of Crank Case Oils, by Prof. Walter F. Weiland, University of Nebraska.
11. Operation of Lubricating Oil Systems, by Paul Williams, Skinner Purifiers, Inc.
12. Development of G-M 2-Cycle, High-Speed Diesels, and their Future, by F. G. Shoemaker, General Motors Diesel Division.
13. Trip to General Motors Diesel plant.
14. Informal Banquet.

THURSDAY, JUNE 22ND

15. Interpretation of Smoky Exhaust of Diesel Engines by Prof. H. E. Degler.

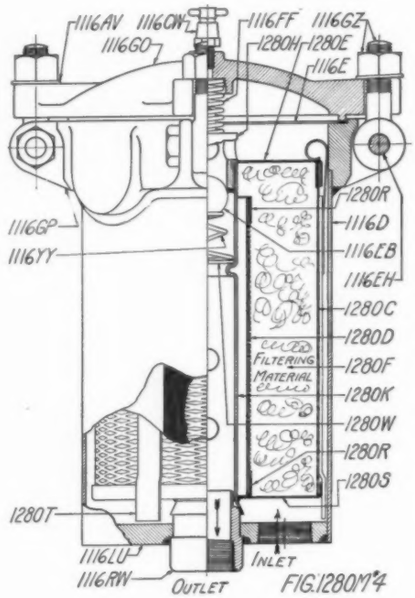
NUGENT ABSORBENT TYPE LIQUID FILTER

THE original filter brought out by Wm. W. Nugent & Company in 1935, known as Fig. 1280, has been improved by the addition of more filtering surface and a bypass relief valve in the same container or shell, besides being more accessible for the removal and replacement of filtering material (waste, wool, excelsior, asbestos, etc.). All of which is illustrated in the accompanying sectional view Fig. 1280M.

There are 14 sizes ranging from 5 in. O.D. x 11¼ in high to 21 in. O.D. x 43 in. high. The capacities when filtering 300 SUS viscosity mineral lubricating oil at 100° F. ranging from approximately ½ to 16 G.P.M. at 20 pounds pressure drop.

The degree of filtration is so good that lubricating oil filters are usually installed to operate on the by-pass partial filtering principle. For instance, in a pressure lubricating system all the oil in circulation may be piped to and from the filter, about 1/6 to ¼ of the circulated oil passes through the filtering material and the balance is shunted through the by-pass relief valve in the filter, the total amount passing from the filter outlet to the bearings.

The filtering material (waste) is easily stuffed into the removable lattice metal cage from a carton containing the correct amount, and so labeled on the outside. The dirty waste is



Nugent Fig. 1280 M Filter.

easily shaken out of the cage after removing the center strainer core. The cage has a removable cover held in place by three loop springs which also center the cage in the shell, thus making a positive seat at the bottom outlet of the filter cartridge or cage.

A fixed spring in the cover holds the cartridge tightly on the outlet seat at the bottom of the shell so that the filter may be installed horizontally or on an angle. Side strips on the outside of the cage extend below the bottom, serving as feet for the cartridge to stand upright on the floor and high enough to protect the flared outlet seat of the center spool from damage due to rough handling.

The dirty waste may be replaced with new waste, which is very inexpensive, or washed in fuel oil or kerosene and reused. Working pressure 125 pounds. Some models may be had for 250 and 1000 pounds working pressure.

SANTA FE ORDERS

PURCHASE of 30 new 1000 hp. Diesel switch engines and one 4000 hp. Diesel passenger locomotive was announced recently by Edward J. Engel, president of the Santa Fe. The Diesel passenger engine and 13 of the Diesel switchers were ordered from the Electro-Motive Corporation, of La Grange, Ill.; 12 switchers from the American Locomotive Company, Schenectady and 5 from the Baldwin Locomotive Company, Eddystone, Pa. This will bring the total of Diesel switch engines in service on the Santa Fe to 41 and will give that company a total of 37,500 Diesel hp. in its switching service. With acquisition of the new passenger unit, Santa Fe will have 27,400 Diesel hp. in its streamlined passenger service. When the new switchers are delivered, Santa Fe will have a grand total of 64,900 Diesel hp., the largest fleet of Diesel engines in operation on any railroad in the world. The new switchers will be used at Chicago, Kansas City, and other terminals of the System. Cost of the new power and equipment will approximate three million seven hundred fifty thousand, payment of which will be made in cash. Santa Fe is also asking for bids on 11 lightweight passenger cars of various classes.

Since the Santa Fe began using Diesel-electric locomotives in its streamlined passenger service, such engines have run a total of 4,106,297 miles, or 164 times around the world.

ATLAS SALES

THE Atlas Diesel Engine Corp., the eastern Diesel branch of the Atlas Imperial Diesel Engine Co. of Oakland, California, has been pretty active in closing sales in recent weeks. A list of the most important details follows:

At Orange, Texas. A twin screw pair of 6 cylinder, 11½ x 15 in. engines, each rated to develop 300 hp., are being installed in the tunnel stern, twin screw towboat designed by Eads Johnson, M. E., Inc., and being built for service on the Orinoco River in Venezuela for Asiatic Petroleum Corporation.

At Beaufort, N. C. Two of the well-known fleet of menhaden fishing vessels owned by Mr. J. Howard Smith of New York are being repowered by Atlas engines. A 200 hp. unit is being installed in the boat *Swanson* and a 400 hp. engine in the boat *Annie Dow.*

At Reedville, Va. The menhaden fishing vessel *Peconic,* owned by the McNeal Company of Reedville, is being repowered with a 300 hp. Atlas Imperial. The menhaden boat *Harry K. Fooks,* owned by the Edwards Company of Reedville, is being repowered with a 400 hp. Atlas.

At Baltimore. A 6 cylinder, 9 x 12, 160 hp., direct reversible Atlas engine is being installed in the freight schooner *LaForrest L. Simmons.* This vessel is one of the last of the Chesapeake Bay sailing freighters to continue in service without auxiliary power. She will now make her trips independent of weather conditions. The Chesapeake Bay freighter *Claudia May* is being made ready for repowering with a 160 hp. Atlas engine which will be delivered approximately June 1.

At Philadelphia. The tug *T. J. Sheridan,* owned by Sheridan Transportation Company, 127 Walnut Street, Philadelphia, is being repowered with a 6 cylinder 10 x 13, 200 hp., 325 rpm. Atlas Imperial engine.

At New York. Another of the vessels in Mr. J. Howard Smith's fleet of menhaden fishermen is being repowered with a 200 hp. Atlas at Perth Amboy Dry Dock, Perth Amboy, N. J. The former passenger and freight steamer *Calvert* is being converted to Diesel propulsion at the plant of J. K. Welding Co., Brooklyn. A 6 cylinder 15 x 19, 600 hp. Atlas is being installed with a 6 cylinder, 1200 rpm., 40 hp. Hercules Diesel auxiliary unit.

At Montauk, Long Island. The new 10 ton capacity ice plant being built by Mr. Perry B. Duryea to replace ice storage facilities which

were destroyed during the September hurricane is being powered by a 55 hp., 360 rpm. Atlas engine. The primary purpose of this plant is to produce ice for fishing vessels working out of Montauk, although ice also will be sold for domestic and other purposes.

At New Bedford. The scallop fishing boat *Shannon,* owned by Mr. Joshua Murphy and Mr. Abram Resevitz is being repowered by a 4 cylinder, 9 x 12, 110 hp. Atlas engine. The fishing boat *Frances & Marion,* owned by Capt. Frank Henrique of Provincetown, is having a 60 hp. heavy duty Atlas installed. The fishing boat *Stella,* owned by Capt. Ferdinand Salvador of Provincetown is replacing an 11-year-old 60 hp. Atlas with a duplicate engine. Mr. Carl Beckman of New Bedford has a new fishing vessel under construction at Rockland, Maine, and has ordered a 150 hp. heavy duty Atlas engine. A 4 cylinder, 135 hp., 325 rpm. Atlas is being delivered for the new scallop dragger being built for Mrs. Winifred Martin, 286 Union Street, New Bedford, by Warner's shipyard at Kennebunkport, Maine. Mrs. Martin's other vessel, the *Winifred Martin,* is powered by a 4 cylinder, 110 hp. Atlas.

At Gloucester, Mass. A 200 hp. 6 cylinder 10 x 13, 325 rpm. Atlas engine is being installed in the Gloucester dragger *Paolina,* owned by Capt. Frederick Frontiero, 60 Commercial Street, Gloucester.

The Association of Maryland Pilots, Baltimore, Md., has ordered a 6 cylinder, 15 x 19, 600 hp., 300 rpm., Atlas Imperial engine to be installed in the pilot boat *Maryland,* replacing a steam power plant.

NEW TONG TEST AMMETER

COLUMBIA ELECTRIC MANUFACTURING CO., Cleveland, Ohio, announces a new Tong Test ammeter which gives accurate current readings without breaking the circuit, scraping the insulation or even touching the conductor under test.

The device consists of a compact ammeter with a handle attached, adjacent to which is a convenient trigger for finger touch operation of the tongs which extend from the opposite end of the meter body. By simply encircling the conductor with the tongs and closing them, a clear, accurate reading is registered on the scale. Correct current measurements can be made without transformers, shunts, portable ammeters and millivoltmeters. Just out, bulletin section 400 illustrates and describes this new Tong Test ammeter.

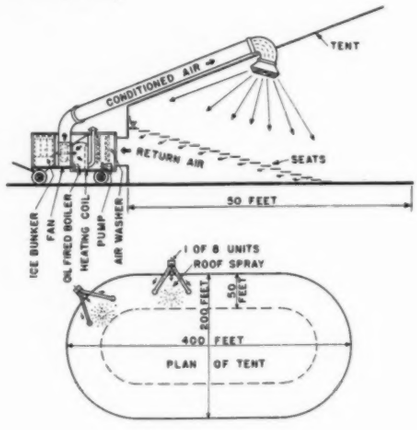
THE CIRCUS GETS AIR CONDITIONING!

THERE'S a new thrill in store for devotees of that great American Institution – the Circus! Ringling Brothers and Barnum and Bailey Circus have just closed a contract with Buffalo Forge Company, Buffalo, N. Y., for comfort cooling for the big tent.

It is believed that this is the first time that air conditioning has been applied to a tent – certainly the first time to a tent this size. Eight complete sets of equipment will be required, each to be mounted on a trailer truck. Through sixteen huge diffusers, cooled air will be discharged into the tent.

Exhaust facilities will permit withdrawal of approximately the same amount of air, so that a constant supply of cooled air will be provided.

Think what this will mean to the circus patron! No more sweltering while the big show is on! Ringling Brothers and Barnum and Bailey have provided comfort never before expected on circus day.



The equipment carried on each of the eight large trailers consists of a Buffalo CL Fan and special Buffalo Air Washer with ice compartments and Aerofin heating coils. Two circulating pumps will spray cold water, obtained with melting of tons of ice per hour, into the Buffalo Air Washer through which the air to be cooled will circulate.

In chilly weather, an oil-fired boiler will provide steam for heating coils which will permit raising the temperature in the tent.

It is expected that the addition of "Buffalo" Comfort Cooling will enable Ringling Brothers and Barnum and Bailey to increase the attendance at all performances throughout the year.

THE George Scherr Company has just introduced a new indicating micrometer and comparator which includes several interesting and important improvements. Among these are the elimination of all gears and racks from the indicator mechanism. Instead, the knife-edge lever type is used, which makes the instrument more accurate, more durable and less subject to loss of precision through constant use.

It eliminates the uncertainty of measuring feel since it includes a feature which makes the measuring pressure visible. There is an anvil relieving button which moves back the lower anvil for inserting and removing work. When the work is inserted and the button released, the anvil is pressed against the work by a light pressure return spring. Thus, no matter who does the measuring, the reading is sure to be the same. Measuring feel does not enter into it.

The "COMPAR" indicating micrometer and comparator is constructed to withstand the constant wear and tear to which an instrument of this nature would be subjected in the machine shop and in quantity production. All delicate mechanism has been eliminated, resulting in a compact, sturdy instrument that measures in 1/10,000" and is built for hard, all-around use. Full information can be obtained from George Scherr Company, 128 Lafayette Street, New York, N. Y.

SUNDLAND JOINS COYNE

DORE SUNDLAND is now associated with Coyne Vibration Control, Inc., 250 West 49th St., New York, manufacturers of vibration absorbing products, including steel spring isolator, natural cork, cork-rubber, etc.

Associated with Mr. Sundland at Coyne Vibration Control, Inc., is Dr. S. E. Slocum, vibration consultant and author of the standard treatise on vibration entitled, "Noise and Vibration Engineering."

DIESEL PROGRESS

INDEX OF ADVERTISERS

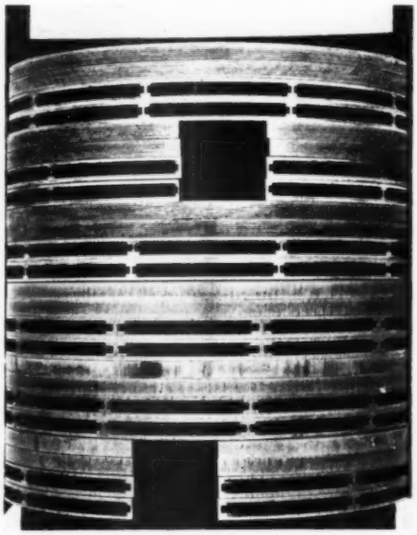
GRANOSEAL PREVENTS SCUFFING

THE wear condition known as "scuffing," which often occurs during the conditioning period in a Diesel engine, has become more acute in recent years due to design trends involving higher piston speeds. The immediate effect of scuffing is a roughening and furrowing of the surfaces eventually resulting in excess wear loss of metal. While this condition obtains wherever any iron or steel surfaces are subject to sliding or rolling friction under conditions of high pressure, high temperature and/or inadequate lubrication our present purpose is to show what has been accomplished on the problem with respect to piston rings.

A study of the causes of scuffing has established that when two pieces of iron or steel are rubbed together under certain conditions, welding or adhesion occurs with subsequent tearing apart of surfaces leaving rough spots. Scuffing is therefore seen to be a function of galling or seizing.

The conditions under which adhesion occurs are metal to metal contact combined with certain temperature and pressure. With the temperatures and pressures present in a Diesel engine adhesion is likely to follow if the oil film fails. Temperature and pressure can cause failure of the oil film and the resultant friction raises the surface temperature. We find then a cycle of events all leading to the ultimate scuffing of the parts.

Obviously the solution lies in eliminating adhesion by maintaining an oil bearing film between the surfaces. Tests with rough finished cylinders, which retained oil, substantiated this theory but such finishes are impracticable. It was further found that scuffing occurs in new engines and that surfaces worn in without scuffing would in time develop an oil retaining film.



Rings from different pistons in the same engine on the same run. Lower half of the stack are rings which were untreated. These show wear and evidence of scuffing. The rings above were Granosealed and still show the original tool marks.

It was therefore indicated that a material which would retain oil was required. It must remain on the piston ring until the wearing surface was conditioned in service to hold an oil film, it must not change the dimensions or shape of the ring nor be abrasive.

The Sealed Power Corp. has worked out a solution to this problem using a phosphate treatment on piston rings, known as Granosealing. This name is taken from the trade name Granodine which refers to a phosphate material for surface treatment of iron and steel manufactured by American Chemical Paint Co.

Piston rings are treated in a bath consisting of diluted phosphoric acid containing some manganese and saturated with iron, with about 2 per cent of free acid, at a temperature of 210 degrees F. The iron is attacked for a short period, which action is soon stopped by the formation of a coating on the surface.

It will be seen that the temperature during treatment is not sufficiently high to distort the ring and it is further noted that essential dimensions of the ring are not changed because the coating ordinarily required for piston rings is approximately 0.00025 of an inch. The coating is non-metallic and yet it rubs down to a polished metallic appearing surface.